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MEDICAL SERVICE
IN
CAMPAIGN

STRAUB

Medical Service in Campaign

A Handbook for Medical Officers in the Field

BY

MAJOR PAUL FREDERICK STRAUB
MEDICAL CORPS (GENERAL STAFF) UNITED STATES ARMY

Prepared Under the Direction of the Surgeon-General, United States Army, and Published by Authority of the War Department

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PREFACE

THE following pages include the substance of a series of lectures delivered at the Medical Department, Camp of Instruction at Antietam, Md., in July of 1909.

It seems desirable that some systematic exposition of the subject should be formulated to serve as a ground work for the instruction of medical officers in camps of maneuver, whereby they and the sanitary units in their charge may take an intelligent part in the exercises.

While this little volume is primarily intended for medical officers of the Regular Army and the National Guard, it is hoped that it may be found useful by other officers, especially by the students at our service schools who must necessarily give some consideration to the disposition of sanitary troops in all of the larger tactical problems.

PAUL FREDERICK STRAUB.

WASHINGTON, D. C.,
June, 1910.

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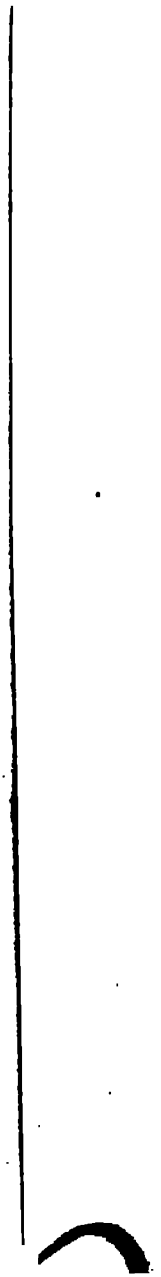


CHAPTER I

INTRODUCTION.

CHAPTER I.

INTRODUCTION.

Since the Spanish-American War the organization and efficiency of our military establishment have greatly improved by the placing of our service upon a strictly modern basis. Our organization, equipment, and tactical instruction have been adapted to the improved firearms in use, and our Army now compares favorably, except in numbers, with those of the leading military nations.

The creation of a general staff marked a momentous epoch, and our important military problems are now solved by a selected body of officers, and the work of co-ordinating the various arms and departments to make a well-balanced organization is well under way.

These changes have also given foreign military literature a new and increasing interest, and many instructive works on "sanitary tactics" or "service of the medical department in the field" have become doubly valuable since the adoption of the common system of medical aid on the battle-field. The model ambulance system devised by Letterman during the Civil War was, in its day, the most efficient ever organized; and his plan must not be overlooked when this subject is under consideration, although it would hardly suffice in the face of modern arms and advanced ideas of military medicine and sanitation.

The new organization and improved weapons have not, however, so completely revolutionized military methods that the procedures which demonstrated their practical value in earlier days should be lightly thrown aside for new schemes evolved from the inner consciousness of theorists. Everyone who is

interested in the service of the Medical Department should read the medical records of our Civil War, beginning, perhaps, with the spring campaign of 1864, when the ripe experience of the previous three years was made the basis of a complete and effective organization. Enormous numbers of sick and wounded were taken care of and transported by the Medical Department in incredibly short periods of time, without embarrassing the movements of the army, and relieving it of an encumbrance that in the earlier years of the war would have paralyzed the force. Upon the foundation laid at that time has been built our modern system of aid on the battle-field, and it is important to a clear understanding of the subject, that the scheme developed under the stress and strain of great campaigns should be well studied. The modifications made necessary by new conditions are then easily understood and can be applied without violating the fundamental principles evolved from practical experience.

In the absence of opportunity to learn from actual experience in warfare, one must be content with a theoretical study of the subject, so that all possible preparation may be made for active service. While theoretical knowledge cannot take the place of practical experience, it can, at least, serve as a foundation for intelligent action when the critical time arrives.

The importance of a theoretical study of military subjects is fully appreciated by our military authorities, as evidenced by the number of service schools now in operation. There are still some who seem disposed to sneer at what they call the "present educational fad" that obtains in our service and to ridicule many things taught therein because they appear trivial to them, apparently forgetting that the details of the greatest undertaking may be small in themselves, but none the less important in finally determining the success or failure of the enterprise.

The highest function of the physician is to heal the sick, and he who does not respond to the cry of suffering is unworthy of his great calling. It is therefore quite natural that the public,

and even some military men, should look upon the medical officer as simply a practitioner of medicine whose sole mission is to relieve pain and heal the sick, and that the one who is well qualified to do life-saving operations and bring patients afflicted with serious diseases back to health is fully able to do all that is required of a military surgeon. The medical officer who lives up to this limited conception would find himself sadly out of place in active service—indeed, he would be only a civilian torn from his quiet routine and thrust into a sphere of action foreign to his taste and training.

It is true that in time of peace, the reputation, character, and influence of the Medical Department rest almost entirely upon the success attained by medical officers in the treatment of the sick civil and military personnel at army posts. This is so well recognized by the Department that the greatest care is taken to select candidates for commission therein who are exceptionally well grounded and trained in the duties of the medical profession. The approved candidates are given a year's special instruction at the Army Medical School, in the branches that are most useful to medical officers; and when finally accepted into the Corps, they have much better opportunities to perfect themselves in their chosen profession than the average civilian physician. Periodical professional examinations of a very searching nature are prescribed, so as to make it absolutely necessary for each and every medical officer to devote his time to the study and practice of his profession if he desires to continue in the service.

In war, however, the utilitarian view of our service must take precedence over the sentimental. Armies are organized and maintained for the purpose of fighting battles and defeating an enemy, and the entire strength and resources of the medical department must also be drawn upon to assist in bringing about a successful issue; and it requires but little argument to show that a properly organized and trained medical department can contribute much thereto by its efforts in maintaining the effective strength of an army. This object is not brought

about, however, by the successful performance of difficult surgical operations nor by the treatment of serious diseases, as men who require such skilled treatment, from the very nature of the cause of their disability, are probably lost to the army. In time of war the military value of the medical department depends upon its efficiency in preventing disease, by sanitation and early treatment of minor complaints, and in relieving an army of its encumbrance of sick and wounded.

Military authorities have at last realized the vital importance of scientific sanitation, and everyone is now fully awake to the fact that stringent sanitary measures have saved many lives, compared to which the loss through bullets seems small. It is impossible to overestimate the influence that sanitary conditions have had upon campaigns, and the lessons to be learned from a study of the wars of the past may well command the serious attention of every military student.

Ample provision has been made for the education and training of the medical officers of our army for the duties that will be required of them in time of war, except in so far as the very important service of relieving an army of the encumbrance of sick and wounded is concerned. The presence of a large number of sick and wounded with a command not only complicates the supply and transportation problem, but also has a very depressing effect upon the mobility of an army, and, as so much depends upon the latter quality, it is reasonable to believe that an efficient service of the medical department may have a powerful influence in determining a successful result. It has often been remarked by experienced military men that a considerable percentage of sick and wounded with an army in the field, in the absence of a proper evacuation service, would paralyze the force.

In the very conservative foreign armies much attention is given to the training of medical officers and medical department units in preparations for field service, and regular courses of instruction are provided and all are given frequent opportunities to make a practical application of their knowledge at periodical field exercises and maneuvers.

Our foreign confrères have long realized the importance of such studies, as evidenced by the large and constantly increasing number of interesting publications on the subject, many of which contain problems illustrating the general principles which underlie the service of the medical department in the field. Some of the problems are based upon actual campaigns and illustrate battle tactics, the influence of time and terrain, and the sequence of important events, which are very instructive and give an insight into the subject that could otherwise only be obtained by actual experience in battle.

Too little attention has been given to this matter in our service, although a decisive step was taken when a medico-military problem was included in the examination of majors for promotion, which serves to call the attention of all medical officers to the necessity of qualifying in the subject.

There is every prospect that the study of "sanitary tactics" or the "service of the medical department in the field" will be made a requirement in the examination of every medical officer. The chief reason for our backwardness in this respect has been the lack of a sufficient number of medical officers to do the strictly professional work in time of peace, and it was not considered practicable to divert the energies of the limited number in service to the preparation for some possible future emergency when the one at hand demanded their entire time and attention.

Of all the subsidiary departments, the medical has been, perhaps, most affected by the change in organization and tactics made necessary by the introduction of modern weapons. Military authorities agree that wars of the future will consist of a series of decisive battles, following in rapid succession one upon the other, and entailing enormous numbers of sick and wounded. Such conditions will make the work of the medical department very arduous and the proper disposition of its organizations a matter of great importance. The longer range and greater penetration of the new rifle bullet have made the problem of the rescue and transportation of wounded from the battle-field much more difficult, although

the same necessity exists, as heretofore, for their speedy shelter and treatment.

There is every reason to believe that the very large armies coming in conflict in a war with one of the powers would have a proportionately large percentage of casualties, and, as it is not practicable to maintain a medical department sufficiently large fully to cope with such extraordinary emergencies, for the reason that it is too cumbersome and expensive, it is highly important that the relatively inadequate force should be trained to the highest state of efficiency. This state of efficiency can only be brought about by the requirement that, in addition to professional qualifications, medical officers shall be sufficiently instructed in such purely military subjects as may be necessary to enable them to act in harmony with the troops they are serving.

There is no denying the fact that it is treading on debatable ground to advocate the study by medical officers of the subjects taught and practised by the line of the army; but it requires little argument to show that a medical officer cannot perform all of his duties efficiently if he does not thoroughly understand the military situation upon which he is expected to base his plan for the relief of the sick and wounded. The sanitary regulations of all armies provide that in case of emergency, the medical officer shall act upon his own responsibility in matters that pertain to his department, and if he expects to perform his duties properly and avoid conflict with the plans and purposes of other troops, he must possess a clear knowledge of the special military situation that confronts him. When such emergencies arise, it is too late then to seek counsel and advice from the commander or his staff, as they are all probably engaged in more important affairs.

It is by no means necessary that the medical officer should be required to make a profound study of the military art, but he must have sufficient familiarity with it to know how to adapt his dispositions to the tactical situation, to interpret orders, and to formulate his own clearly and concisely,

subordinating and harmonizing them with those of his commander. A working knowledge of map reading and the properties of ground, a correct estimation of distances, of the danger zone, and of the range of modern firearms would all seem to be necessary to locate properly the medical department stations.

Before beginning the study of sanitary tactics or attempting the solution of medico-military problems, it is essential to have a thorough understanding of the following subjects:

1. Medical Department regulations and organization in peace and war.

2. Field Service Regulations concerning the medical department, rate and length of marches, length of columns, and the capacity and efficiency of the means of transportation for wounded and medical supplies.

3. Army organization in general, and especially so much as concerns the lines of communication.

4. The special conditions and circumstances which attend the service of troops on the march, in camp, and in action.

5. Administrative methods at the various headquarters, and the formulation and interpretation of orders.

6. Map reading and terrain.

Nearly all of the information thus required is to be found in the Army Regulations and the various manuals issued by the War Department, but it requires considerable study to bring the rules and regulations together in such a way as to be able to apply them to a concrete case. An imperfect knowledge thereof would only lead to confusion, and no attempt should be made to solve medico-military problems without the essential preliminary study.

It is presumed that the reader of the following pages is well grounded in the regulations bearing upon the service of the medical officer in the field and is prepared for a discussion of the method of conducting the service during and after an engagement.

CHAPTER II.

COLLATERAL MILITARY SUBJECTS.

1. Preparation for Field Service.
2. Orders.
3. Map Reading.
4. Weapons.
5. Casualties.
6. Transportation.

CHAPTER II.

PART I.

PREPARATION FOR FIELD SERVICE.

The Field Service Regulations of our Army and, as a matter of fact, for nearly all other services provide that in case of emergency medical officers may be authorized to issue orders to their subordinates in the name of their commander, which renders it absolutely essential that medical officers should endeavor to fit themselves for such functions, as the emergencies referred to are liable to arise during the course of any battle, when the time and attention of the commander and his chief of staff are taken up with more pressing duties.

It is quite clear that the adminstrative medical officer in the field cannot properly perform his full duty unless he is fairly familiar with certain branches of the military art, which are necessary to a clear understanding of the situation to which he is expected to adapt his plans for the succor and care of the sick and wounded. It might be thought that such studies would tend to divert medical officers from their primary function of the care of the sick and wounded, but it requires little argument to show that it immensely facilitates that very purpose. The amount of study required to get a sufficient knowledge of the military topics concerned is but child's play compared to any one of the numerous branches of a medical curriculum, yet the information that can thus be acquired may make all the difference between failure and sucess of the medical service on the field of battle.

In the following pages are given some of the elements of the subjects that cannot be classified under the head of sanitation or other professional headings.

CHAPTER II.

PART II.

ORDERS.

Medical officers must not only be able to properly interpret orders, but to issue them in proper form and in accordance with the instructions laid down in the regulations. (Field Orders, Messages and Reports, by Major Eben Swift, 12th Cavalry.) While there is much on the subject that does not appear to have any special application to medical officers or the medical service, it is still of vital importance that every medical officer should have a clear understanding of all orders and instructions, so that he may adapt and subordinate his directions to the general plans prescribed therein.

It would be unwise to attempt to introduce for the medical department a special system of communication with subordinates, and therefore, authorized military methods must be closely followed and orders of chief surgeons and other administrative medical officers must of necessity conform to the established custom.

In the following pages the plain and explicit directions given by Major Eben Swift are very largely quoted.

A military order is an expression of the will of the chief conveyed to subordinates. The higher the position of the issuing authority the more general in character must be the orders.

At the beginning of a campaign, and from time to time thereafter, the intentions and plans of the supreme authority will ordinarily be communicated to subordinates in the form of letters of instruction. Under similar conditions, chief surgeons of armies or of field armies, will, under the authority of the com-

mander, instruct subordinates in matters which pertain strictly to their respective departments. Such letters of instruction will regulate movements over a large area and for a considerable time prescribe a general objective, or, in the case of the medical service, the sanitary regulations and general plan for the care and evacuation of the sick and wounded and the renewal of supplies, etc.

Orders are classified as:

1. Ordinary Orders.
2. Orders.
3. Field Orders.

Ordinary orders are the orders for regiments and all larger commands, territorial and tactical, as well as for military posts and permanent camps, and are denominated *general* or *special* orders, according to their character.

General orders publish matters of importance to the whole command which are of permanent interest or are to be constantly observed, such as hours of roll calls and duties, police regulations and prohibition laws and regulations for the army, eulogies and censures and results of trial by general courts martial.

Special orders are such as concern individuals or relate to matters that need not be made known to the whole command. Orders issued by chief surgeons of large commands to subordinates are necessarily special.

Orders of commanders of smaller units, including field hospitals and ambulance companies, are simply called "orders."

For field service another class of orders is needed, which deal entirely with the tactical and strategical details incident to a state of war and prospect of contact with the enemy. They are denominated "Field Orders" and are numbered serially for each command.

All orders except "Field Orders" are numbered in series beginning with the year or with the establishment of an organization.

Circulars, memoranda, and letters of instruction are sometimes rather loosely used in place of orders.

Explanations, apologies, and guesses are signs of weakness in a commander. Undue interference with subordinates is inadvisable as it tends to relieve them of the responsibilities of their positions. The local minor authority may often be in a better position to determine the manner of carrying out the details of a plan than higher officers, on account of a better knowledge of the local conditions.

It is unwise to attempt to make provision in orders for all possible contingencies that might arise during the course of operations.

During active operations the orders of chief surgeons of large commands should ordinarily only give general directions, leaving it to the medical officers directly concerned to work out the details; in other words, a certain amount of elasticity must be maintained, so that due allowance may be made by the authorities designated to carry the order into effect, for local or peculiar conditions of which higher authority may have no knowledge, and for sudden and unexpected changes in the situation.

The use of such terms as "before," "behind," "in rear," "this side," or other expressions that may easily appear ambiguous should be avoided whenever it is possible to indicate the plan or position by giving its compass bearings from well-known points. The terms "right" and "left" should not be applied to inanimate objects and must be restricted to reference to individuals or bodies of men or to the banks of streams, in which case the observer is supposed to be facing *down* stream. Expressions such as "as far as possible," "as well as you can," should not be used as they tend to divide the responsibility between the chief and his subordinates instead of leaving it where it belongs.

Orders must be brief, concise, and clearly expressed, and a positive form of expression invariably used. An order reading that "the wounded will *not* be evacuated via the SHARPSBURG-

BOONESBORO road" is objectionable, because the gist of the order lies in a single word.

It would hardly seem necessary to say that all orders and letters of instruction should be clearly and distinctly written, as they may have to be read under unfavorable conditions of light and weather.

The importance of adopting an almost invariable model for field orders, so that omissions may easily be detected is generally recognized.

MODEL FIELD ORDER.

1st Division, Northern Army.
2 July, 1909, 7 P.M.

Field Orders
No. 12

1. The Blue Army from the east has halted on the line of the Washington County Branch of the B. & O. R. R., with its outposts on ANTIETAM CREEK.

The Red Army, from the southwest, has taken up a position on the ridge just west of ANTIETAM CREEK.

From the reports of patrols, spies, etc., the Blue Commander decides that the line SHARPSBURG-WEST WOODS is very strongly held. While nothing definite can be learned of the line to the south of SHARPSBURG, the Blue Commander is of the opinion that that portion of the line is but weakly held.

Red outposts occupy the high ground all along the right bank of ANTIETAM CREEK.

2. This Division will attack and envelop the enemy's right flank tomorrow.

3. (a) The Artillery Brigade will take up its first position as soon as the 2nd Brigade moves from bivouac, and will support the infantry attack.

(b) The 1st Brigade and 2nd Brigade will compose the fighting line and they will move out from bivouac at 5 A.M. The 1st Brigade will form on the Valley Road just north of SHOW-

MAN'S. The 2nd Brigade will form on the north and east of VALLEY ROAD, connecting with the 1st Brigade.

ANTIETAM CREEK is fordable at all points.

(c) The 3rd Brigade will constitute the reserve and will follow in rear of the left flank of the 2nd Brigade.

(d) The divisional cavalry will cross ANTIETAM CREEK to the left and at the same time as the 2nd Brigade, and will cover our left.

(e) The Engineer Battalion will support the Artillery.

(f) The Signal Troops will establish and maintain communication by wire between the different Brigade Headquarters, the Artillery position, the trains and Division Headquarters.

4. The ammunition and supply columns will remain in their present position.

A collecting station for slightly wounded will be established at ROHRERSVILLE.

A dressing station will be established at the GRUNE HOUSE.

A field hospital will be established at the W. SMITH HOUSE.

The remaining ambulance companies and field hospitals will remain in their present positions.

5. Reports will reach the Division Commander at present headquarters.

By command of Major-General A.

B. C.,
Chief of Staff.

The caption is the heading of the order and consists of the official designation of the command from which the order is issued. It gives the place and date, and sometimes the hour and minute of issue, the series and the number of the order.

The body of the order is divided into numbered paragraphs which are without headings. The 1st paragraph contains information of the enemy and so much of the general situation of our troops as is deemed necessary for subordinates to know.

Paragraph 2 gives the object of the movement or instructions covering as much of the general plan as are considered to be necessary in order to insure proper co-ordination in the movement of all commands.

Paragraph 3 gives the disposition of troops adopted by the commander to carry out the purpose indicated in the previous paragraph and includes the tasks assigned to each of the several fractions of the command,

Paragraph 4 gives the necessary orders for ammunition columns, trains, and sanitary troops, and may contain directions as to the disposition to be made of sick and wounded and the reserve supplies. In battle orders this paragraph may also contain the necessary instructions concerning the establishment of

Collecting stations for slightly wounded,
Dressing stations,
Field hospitals,
Reserve supply depots.

In fact, everything that may apply directly to the service of the medical department on the march or in battle that is deemed of general importance to the whole command may be included therein.

The chief surgeon of a division or an independent smaller command would be expected to submit his recommendations concerning the service of the medical department in the form in which they are to be included in the march, camp, or battle orders as follows:

"The sick of the command will be assembled at ROHRERSVILLE by 5:20 A.M. to-morrow."

"Collecting station for slightly wounded will be established at KEEDYSVILLE."

"A dressing station will be established at the GRUNE HOUSE at the junction of the VALLEY and SHARPSBURG roads."

"Empty supply wagons will be placed at the disposition of the chief surgeon for the transportation of the wounded."

However, the manner in which these orders are to be executed and the personnel designated to accomplish it will ordinarily not be given in the division orders, as such details are of no importance to the command as a whole, but will be communicated in special orders to those directly concerned in the execution thereof. The necessary instructions will be given in special orders issued by the chief of staff or by the chief surgeon, under the authority of the commander. Thus the ambulance company that may be designated to assemble the sick or to establish a dressing station will receive the necessary instructions in the form of a special order.

Special Orders, No. 15.

1st Division, Northern Army,
Office of the Chief Surgeon,
2 July, 1909, 8 P.M.

Ambulance Company No. 1 is designated to establish the dressing station required by paragraph 4, Field Orders, No. 12.

A. B.,
Lt.-Colonel, Medical Corps,
Chief Surgeon.

Paragraph 5, with few exceptions, contains the necessary information as to the place where the commander can be found or where messages may be sent. This information is of importance to the medical department principally as an indication of where the chief surgeon may be found.

In the margin of an order the medical department units are designated as follows:

1st F. Hosp.
2d Amb. Co.

Fractions of such and smaller organizations are designated thus:

Sec. 1st F. Hosp.
Sec. 2d Amb. Co.
Detach. Hosp. Corps, 6th Inf.

One or more ambulance companies are usually assigned to

the column of troops of the division on the march, the remainder with the train.

In the presence of the ememy, an ambulance company, or a section thereof, with complete or light (pack mules only) transportation, may march in rear of the advance guard.

Under all ordinary circumstances field hospitals march with the field train. Regimental detachments of the Hospital Corps habitually march with their units.

Ordinary abbreviations are used in the caption, margin, and ending.

A road is always designated by naming several places along its line, as SHARPSBURG-KEEDYSVILLE-BOONESBORO road.

As it is extremely important that names of persons and places given in the body of an order should be clearly understood, it is advisable that they be emphasized by writing them in CAPITALS.

Messages and Reports in the field are sent on regulation blanks. The sender fills in the hour and minute of despatch and indicates the rate of travel.

"Ordinary" means about 5 miles an hour for a mounted man; "rapid" necessitates trotting 7 to 8 miles per hour; "urgent" demands the highest rate of speed consistent with safety and certainty of arrival at destination.

It is customary to leave the envelope open so that commanders along the line of the messenger's route may read the contents. If it is desirable that the contents be unknown the envelope should be sealed and marked "confidential." The recipient fills in the time of receipt and returns the envelope to the messenger.

The heading, "sending detachment," should be filled in with the name of the body of troops with which the writer is serving, as F. Hosp. No. 1, etc.

Several messages sent during the day from the same source to the same person should be numbered consecutively below the heading, "Sending detachment."

The signature should consist only of the surname and ra
The rules adopted to insure clearness and brevity in ord
should also be followed in writing messages.

A report is a more elaborate communication, which give
complete narrative of some important action or event and th
is not the necessity for brevity and conciseness as in the c
of orders and messages.

CHAPTER II.

PART III.

MAP READING.

A knowledge of the rudiments of map reading is of importance to the medical officer in the field and for the solution of theoretical medico-military problems.

Only a few facts and rules are cited, as much of the matter given in books on the subject is important only to those who may be expected to make maps. It must be understood that some practice in the field is required and the student should take advantage of the opportunities afforded during practice marches and other field exercises.

By map reading is meant the ability to grasp the general features of a map and to form a clear conception or mental picture of the ground represented by the map, the corresponding distances on the ground, the network of roads and streams, the heights, slopes and all forms of military cover and obstacles. These are all of importance to the medical officer, especially in the selection of medical department stations and routes for the evacuation of wounded from the battle-field.

The United States Geological Survey map is the standard, but special military maps drawn on a larger scale are sometimes furnished for special field exercises. Three scales are employed in the geological survey maps. The largest is 1:62,500, or very nearly one mile to the inch; that is to say, one linear mile on the ground is represented by one linear inch on the map. An intermediate scale, 1:125,000, or about two miles to one inch, and a third and still smaller scale of 1:250,000, or about four miles to one inch are used. The features shown on these maps may be classed in three groups: *a*. Water, including seas, lakes,

ponds and streams, which are shown in *blue*. *b*. Relief; including mountains, hills, valleys and cliffs, shown by contour lines in *brown*. *c*. Works of man, such as towns, cities, roads, railroads, and boundaries, shown in *black*.

There are four essential points to be observed in reading a map:

1. Conventional signs.
2. Distance.
3. Direction.
4. Contours.

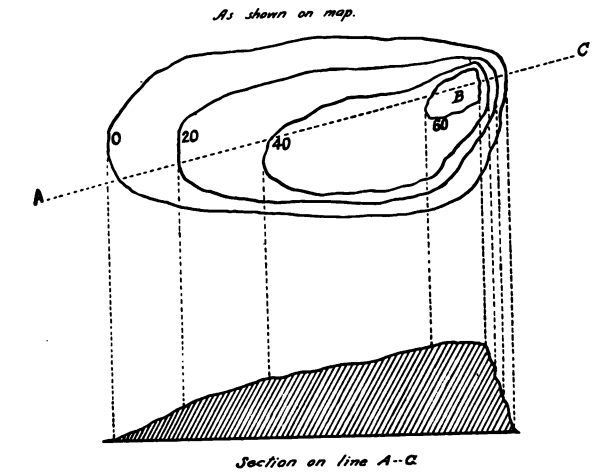
(1) The conventional signs that are of the greatest interest to medical officers are indicated above and are quite obvious.

(2) Distances are to be determined by the scale shown on every map, although occasionally the scale is indicated by a representative fraction. Thus a "mile to the inch" scale may be characterized by the fraction 1/62500 and "two miles to the inch" as 1/125000, etc.

(3) On the geological survey maps *North* always corresponds to the top of the sheet, although in other maps it may be indicated by an arrow.

(4) Each brown contour line passes through points which have the same altitude. One who follows a contour on the ground will neither go up hill nor down hill, but always on a level. The contour interval, or vertical distance in feet between one contour and the next is stated at the bottom of the map. Contours enable us to determine the relative heights of different points on the map. They also show the shape of the hillsides, whether concave or convex, and, most important of all to us, the cover that might be afforded for aid and dressing stations. Thus an elevation and a depression as indicated by contour lines would appear on the ground as shown in Fig. 1. It will be observed that contours close together indicate sudden rise or fall of ground, and when far apart a more gentle slope.

To make use of a map the observer must first locate his exact position on the map, which may at times be quite difficult. By noting prominent landmarks, towns, streams, the compass


As shown on map.
C
B
60
0
20
40
A
Section on line A--C

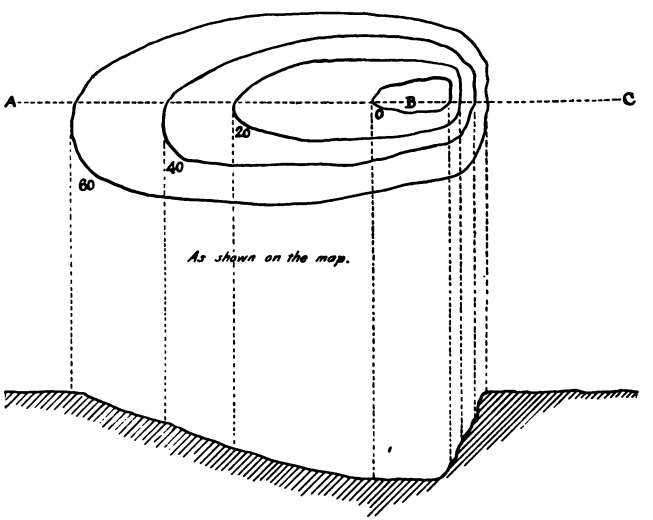

A
C
B
0
20
40
60
As shown on the map.
Section on line A--C.

FIG. 1.

bearing of the road or roads, and the contour of the ground, it is usually possible to arrive at a proper conclusion. After the place occupied has been noted on the map, the sheet is to be turned so that the upper edge is to the north (or so that the arrow points in that direction). A compass is an essential instrument in all such exercises, although when the sun is visible the well-known method of determining direction by means of a watch may be used. When a map has thus been oriented, the direction of roads, etc., is at once clear. If, when traveling along a road, the direction, approximate rate of speed, prominent landmarks, cross roads, streams, and the configuration of the ground are noted, no great difficulty in keeping track of the position on the map will be encountered after a little practice. As suggested above, the beginner should take advantage of every opportunity in the field to practise the art of map reading, and the difficulties that he may first encounter will rapidly disappear.

Very simple sketches showing locations of aid and dressing stations and evacuation routes may readily be made from a map with a few strokes of a pencil. These sketches can be made to indicate relative positions much more clearly than by written description; can be read quicker, and are less liable to be misinterpreted. (Fig. 2.)

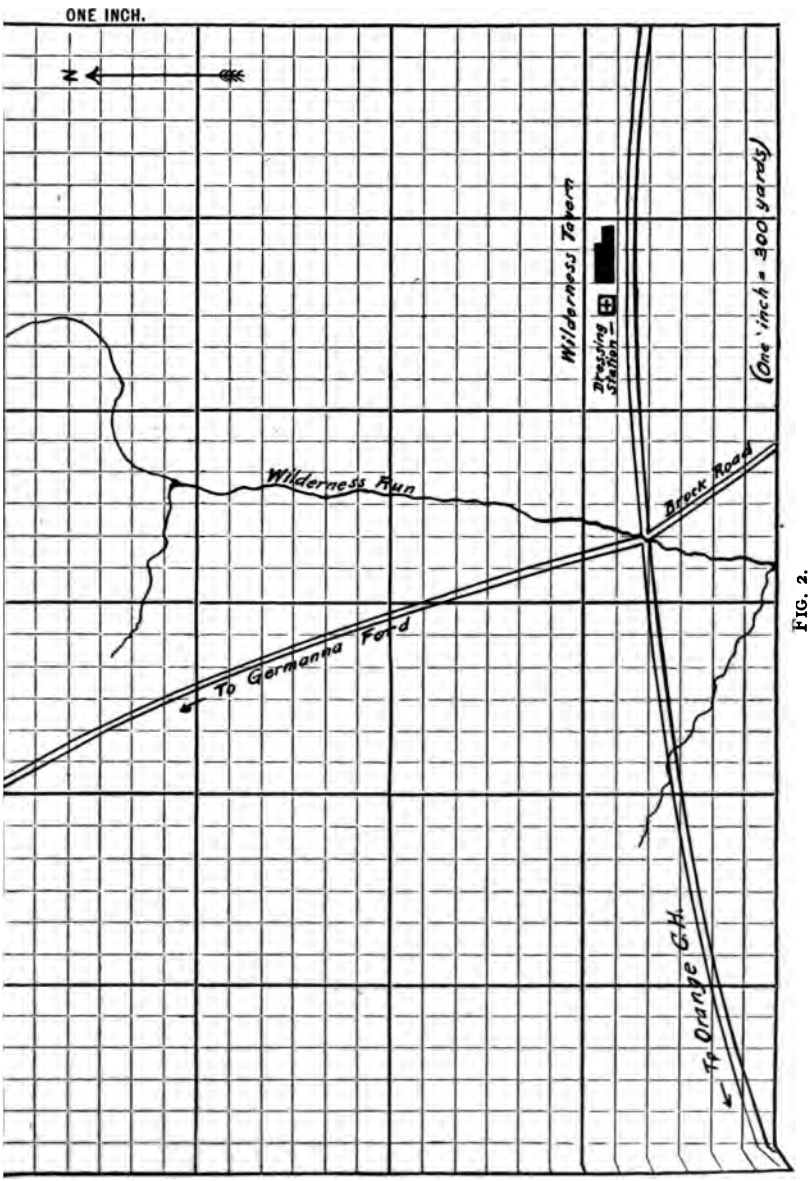

ONE INCH.
N
Wilderness Tavern
Dressing Station
(One inch = 300 yards)
Wilderness Run
Brock Road
To Germanna Ford
To Orange C.H.

FIG. 2.

CHAPTER II.

PART IV.

WEAPONS.

The range and efficiency of firearms have an influence upon the medical service in battle that cannot be disregarded. Not only is the character of wounds largely determined thereby, but the dispositions and uses of the medical department units also depend very much upon the trajectory, range, and penetration of the projectiles in use.

Wounds inflicted by modern rifle bullets are, generally speaking, less severe than those produced by the old large-caliber muskets, and with modern surgical methods a much larger proportion of those wounded in action may be expected to return to the ranks. However, the greater range and efficiency of modern weapons makes the rescue and removal of the wounded from the battle-field much more difficult, although the same or even greater necessity for their speedy rescue now exists than formerly, in view of the fact that by prompt surgical assistance a very large proportion of those injured in battle may soon be able to resume duty at the front.

Very little difference exists between the military rifles adopted by various countries as far as concerns the medical department, as indicated by the following table:

Country	Caliber	Sighted up to
United States	.3	2850 yards
Austria	.315	2187 yards
Great Britain	.303	2786 yards
France	.315	2187 yards
Germany	.311	2187 yards
Japan	.256	2187 yards
Russia	.3	2096 yards
Spain	.275	2187 yards

The maximum range of the U. S. magazine rifle is 5465 yards, and the angle of elevation necessary to attain this range is approximately 45°; the time of flight being 31.36 seconds.

The danger space caused by rifle fire is the sum of the distances in the path of the bullet in which an object of given height will be struck.

The point-blank danger space means the distance in the path of the bullet where the ordinates of the trajectory are not higher than 68 inches, which is taken to be the height of the average man.

Point-blank Danger Space.

	Assumed height of line of sight above ground. Inches	Point-blank danger space (computed). Yards
Firing standing.....	56	718.6
Firing kneeling.....	30	629.4
Firing lying down.....	12	589.7

At 1000 yards fire would usually be effective at a line of skirmishers at five yards' interval, and up to 1200 yards on a line of skirmishers at one yard interval.

Fire upon a body of troops at close order of the width of 12 to 15 yards will generally be effective up to 1000 or 1200 yards; upon a body of men with a front of 20 to 25 yards, or upon a section of artillery up to 1200 to 1500 yards, and upon troops in columns of companies or compact bodies of artillery or cavalry at ranges from 1500 to 2000 yards. Beyond 2000 yards, infantry fire will not usually be effective except at very vulnerable targets, such as would be presented by large bodies of troops in mass under conditions which favor bringing the objective within the beaten zone.

We are not, however, so much concerned with the effects of aimed fire as we do not propose to make our stations a target for the enemy's shots, and it is the badly aimed or the shots fired without aim that interfere most with our arrangements. In severe engagements the aimed shots are comparatively few in number, and the badly aimed or overshots cover a deep zone with a rain of projectiles—the extreme limit thereof may be taken

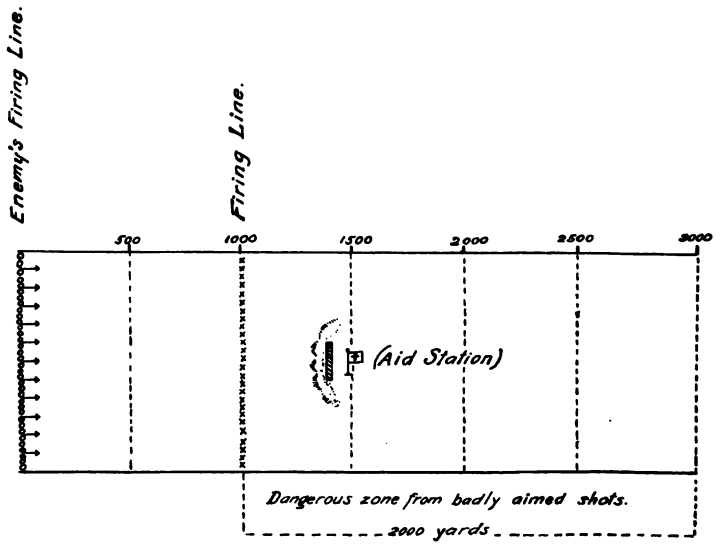


FIG. 3.

to be about 3000 yards from the firing point as shown in Fig. 3. Some bullets will fall beyond and laterally to this zone, but little danger is to be apprehended therefrom. The danger zone does not correspond to the maximum range of the rifle, as it is not probable that any considerable number of men will fire their pieces elevated at an angle of 45 degrees, the angle necessary to attain the maximum range.

The extent of the danger zone from overshots also depends upon the height above the ground from which the fire is de-

livered; upon the flatness of trajectory, the height of object, the distance from the origin of the fire, and the configuration of the ground upon which it is situated. If the ground where the object is situated is not horizontal, its slope will materially influence the extent of the danger space. If the object is on rising ground, the angle will be increased and the danger space thereof diminished, but if it is on falling ground, the danger zone will be increased as the slope of the ground becomes greater. In studying the trajectory of missiles from modern rifles it would appear that in firing at a crest 1000 yards distant and 30 yards above the firing point, the danger zone from badly aimed shots

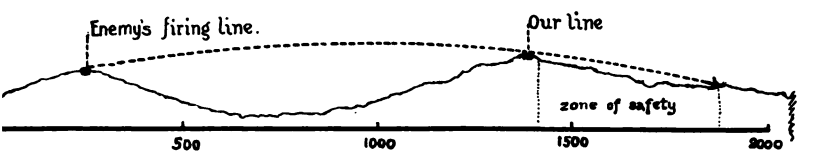


FIG. 4.

begins about 300 yards in rear of the crest, if it is assumed that the ground behind it falls to the level of the firing point. In this zone of comparative safety the collection of wounded and the application of surgical dressings might go on without great risk during the progress of a battle. (Fig. 4.) Should the difference in height between the firing point and the objective be still greater, the extent of the zone of comparative safety would be correspondingly increased. On the other hand, there would be no zone of safety in the immediate rear of the lower firing point, and nothing could be done in the way of collecting wounded during the progress of the engagement unless some accident of terrain afforded good cover.

A discussion of the influence of the enemy's fire upon the medical service usually only takes rifle fire into consideration, for the reason that the element of excitement and other disturbing influences do not affect the laying of an artillery piece to the

same extent as in the case of aiming with a rifle, and a danger zone from artillery overshots cannot be spoken of with the same significance. If stations come within the range of exploding shell it must be considered as a consequence of an ill-advised location, near batteries in action, or on ground that would be ranged over by the enemy's artillery to find concealed batteries.

As far as any influence upon the service of the medical department is concerned, it may safely be assumed that the artillery armament of different armies is practically the same, and by giving certain data concerning field guns and howitzers in use in our Army, the present purpose will be adequately served:

Field Artillery.

Gun	Caliber	Extreme range	Shrapnel			Shell	
			Weight	No. of bullets	Size and weight of bullets	Weight	No. of effective fragments
Field gun and howitzer.	3 in.	6500	15 lb.	262	.5 in. 167 grains	15 lb.	1200
Mountain gun.	3 in.	5800	15 lb.	262	.5 in. 167 grains	15 lb.	1200
Siege gun and howitzer.	4.7 in.	8000	60 lb.	711	.54 in. 230 grains	60 lb.	3000
Heavy field howitzer.	6 in.	6700	120 lb.	871	.6 in. 288 grains	120 lb.	6000

Area of Dispersion.

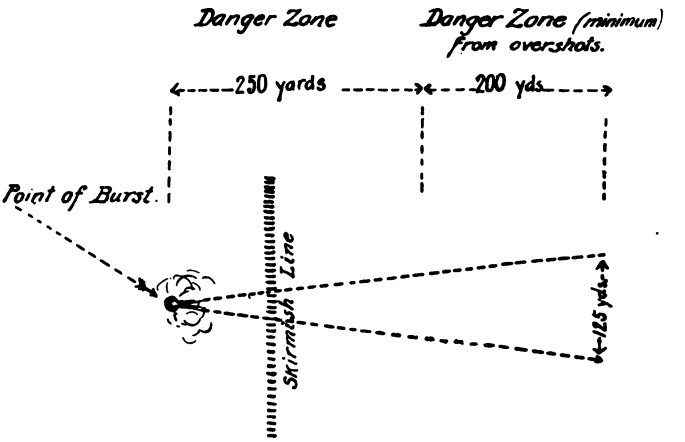
	Gun	Shrapnel		Shell		
		Length	Width	Length	Width	
At a range less than 3000 yards	Field gun and howitzer.	400	150	300	100	Area of dispersion about 100 yards wide and 150 yards long, very effective within a central zone of about 30 yards wide and 20 yards long.
	Mountain gun.	300	100	250	75	
At a range over 3000 yards.	Field gun and howitzer.	300	125	250	75	
	Mountain gun.	200	75	150	75	

As indicated above, projectiles used by modern artillery are of two kinds: shrapnel against animate objects—men and horses—and high explosive shell against material targets, such as batteries and defensive works.

A shrapnel is essentially a thin cylinder or case, closed at the base and filled with round lead steel jacketed bullets which it is designed to carry to a point a short distance in front of the target, there to be expelled with increased velocity over a considerable area. The expulsion takes place through the action of a powder charge placed inside the shrapnel case in the rear of the lead balls. The powder is ignited by the action of a fuse carried in the head of the projectile, so arranged that it can be burst at any desired interval of time after the projectile leaves the gun. Figure 5 indicates the area of dispersion and the danger zone produced by artillery projectiles.

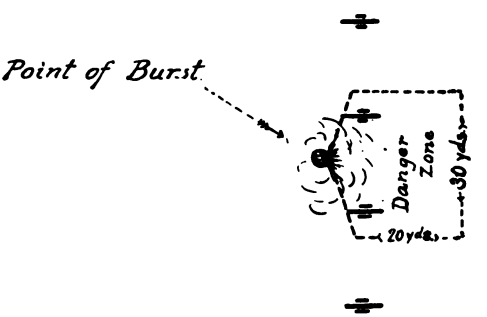
The fuse in the shrapnel is so set as to endeavor to explode it from 80 to 100 yards in front of the target, but owing to variations

SHARPNEL.



Area of Dispersion 16° at medium ranges.

High Explosive Shell



Area of Dispersion 140°.

FIG. 5.

in the action of fuses, the explosion may be expected to take place somewhere within the space extending from about 150 yards in front to about 50 yards in rear. The danger space that may thus be produced extends therefore from 100 yards in front to about 300 yards in rear of the target.

A shell is a thin-walled steel projectile filled with high explosives and provided with a sensitive fuse that acts only when the projectile strikes the ground or other obstacle. There is usually an intentional delay so that it will burst only after burying itself in the ground or when ricochet takes place it will explode a few feet above ground. The first condition is desired when field fortifications are to be demolished and the second when troops are to be reached that are protected from shrapnel by intrenchments.

Efficiency of Cover against Rifle and Artillery Fire.

Aside from the influence that penetration, range, and trajectory of projectiles have upon the number and character of wounds, they are also of great interest to the medical officer in the determination of the efficiency of cover against the enemy's fire, for aid and dressings stations.

It must be distinctly understood, however, that the figures concerning trajectory and slope of fall of artillery projectiles have no reference to those fired at high angles from howitzers.

It has also been estimated that 2.5″ of soft and 1.5″ of hard wood, and 15″ of loose earth or sand will stop shrapnel bullets, fired at medium and long ranges and afford effective cover against them.

The effect of high explosive shells is so powerful that ordinary cover, such as light stone walls, ordinary buildings, etc., afford but little protection, and it is hardly worth while to attempt to make an estimate of the probable resistance offered thereto by various materials.

The penetrative power of the new sharp-pointed bullets is given below and indicates the protection that might be afforded by natural or artificial cover.

Material	Penetration inches			
	50 feet	100 yards	500 yards	1000 yards
White-pine butts, made of 1-inch boards placed 1 inch apart.	33.5	46.7	24.3	12.8
Moist sand	8.7	.....	13.4	12.5
Dry sand	4.	.....	9.2	7.5
Loam practically free from sand.	14.	.....	18.8	18.6
Mild steel plate, 0.493 inch thick.	0.446	0.259	.....	
Mild steel plate, 0.3843 inch thick.	Through	Through	.....	
Gun shield steel plate, 0.20 inch thick.	Through	Through		
Thoroughly seasoned oak, across the grain.	12.2	33.6	.....	
Brick wall	.....	5.0	.....	

The trajectory and more especially the angle of fall of projectiles as shown in (Figs. 6 and 7) must always be considered when the question of establishing a station within the danger zone from overshots arises. It is easily seen that a site for a station or an evacuation route might be selected, which would be entirely concealed from the enemy's view, but nevertheless as much exposed to his overshots as the obviously exposed high ground in the neighborhood.

As an illustration, let it be supposed that Fig. 8 represents an area of a "two inches to the mile, 20 feet contour interval map," and that the establishment of an aid or dressing station was contemplated at "A." By measuring the distance between the 500 and the 440 feet contour lines, which indicate a fall of 60 feet, it will be found that the slope of fall of a rifle bullet

fired from a distance of 2000 yards, the position of the enemy's line, corresponds to the slope of the ground, consequently the

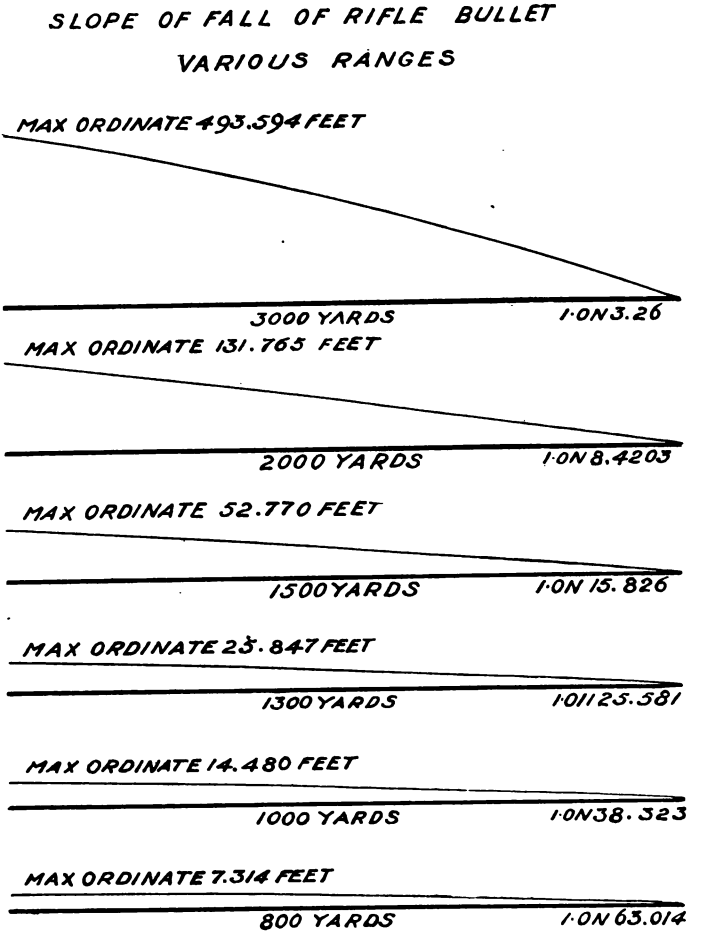


FIG. 6.

point "A" would be as much exposed to overshots as the crest at "B." (The distance between the contour lines at "A" and "B" is approximately 500 feet, and the difference between the

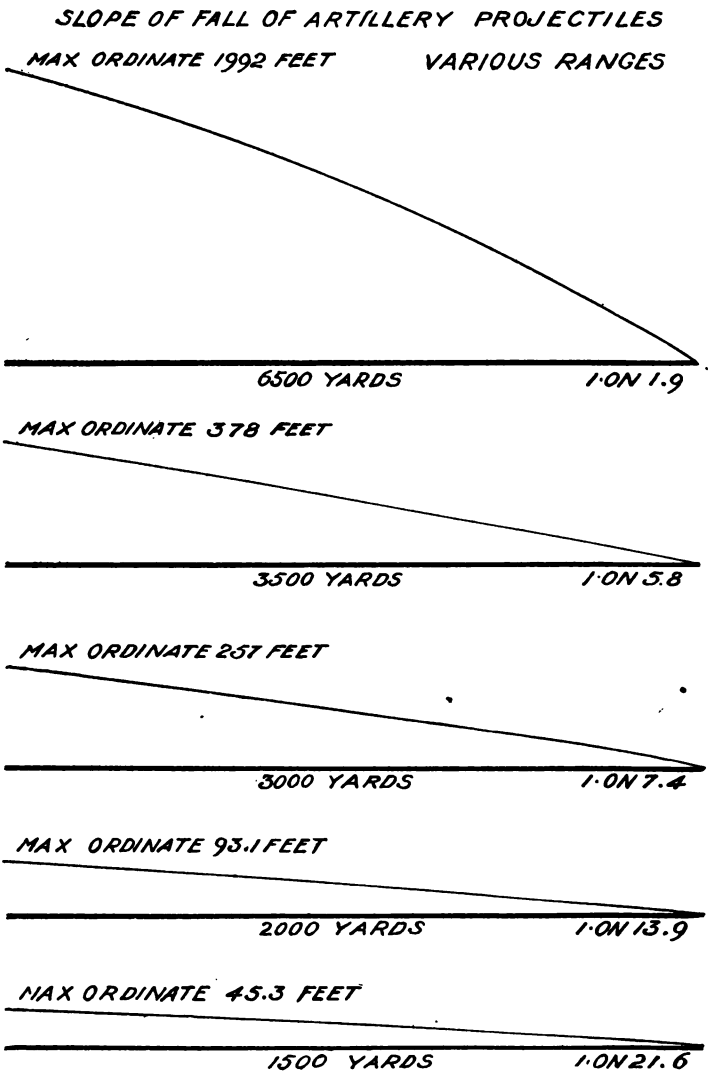
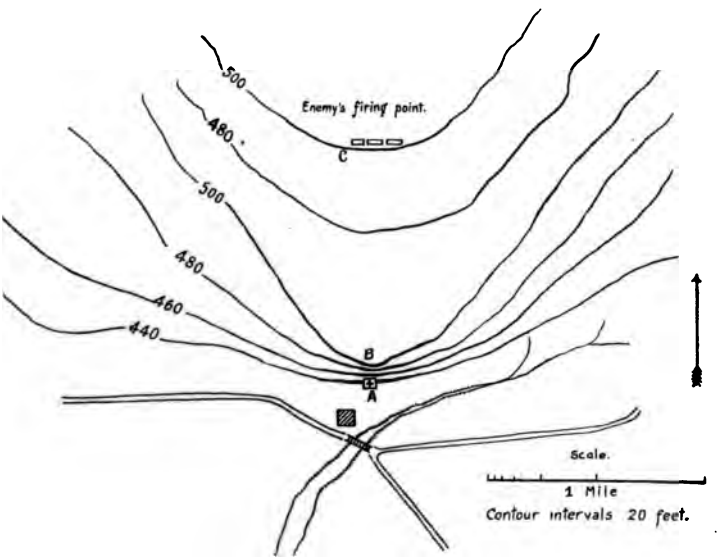

SLOPE OF FALL OF ARTILLERY PROJECTILES
MAX ORDINATE 1992 FEET
VARIOUS RANGES
6500 YARDS
1·ON 1.9
MAX ORDINATE 378 FEET
3500 YARDS
1·ON 5.8
MAX ORDINATE 257 FEET
3000 YARDS
1·ON 7.4
MAX ORDINATE 93.1 FEET
2000 YARDS
1·ON 13.9
MAX ORDINATE 45.3 FEET
1500 YARDS
1·ON 21.6

FIG. 7.

Slope of fall of rifle bullet
at 2000 yards range - 1 on 8.4203 feet.



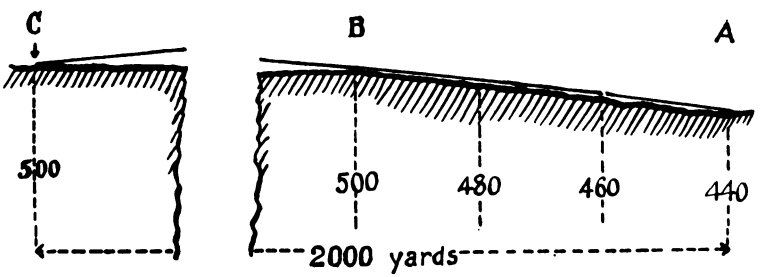


FIG. 8.

500 feet and the 440 feet contour lines being 60 feet, the slope of fall of the ground is about one on eight, which practically represents the slope of fall of a rifle bullet fired at 2000 yards).

By reference to the next table it may be determined how large a space would be protected against rifle fire at various ranges by obstacles of certain heights. Such information may be of value when a large dressing station is to be established within the zone of overshots:

Range	Height of obstacle necessary to give cover to a soldier at the following distances in the rear thereof.*					
	10 yards	20 yards	50 yards	100 yards	150 yards	200 yards
yards	feet	feet	feet	feet	feet	feet
500	5.8	6.0	6.4	7.0	7.4	7.6
1,000	6.3	7.1	9.2	12.2	14.6	16.6
2,000	9.1	12.6	22.6	38.4	53.1	65.8
3,000	15.6	25.1	50.6	91.7	131.1	167.8

* Note.—Assumed that line of sight is horizontal and height of man is 68 inches.

CHAPTER II.

PART V.

CASUALTIES.

Before attempting to describe the system for the relief of the wounded on the battle-field it would seem to be quite necessary to inquire into the subject of battle casualties so that some estimate may be made of the losses to be expected and thus give an idea of the task which may confront the medical department.

The study of battle losses is beset with many difficulties and yields only approximate results, for it must be based upon statistics seldom reliable and assume factors which are liable to many and unexpected variations. But in no other way can we obtain the information necessary for calculating the probable needs in personnel, supplies, and transportation of the department.

Until very recently, the carefully prepared casualty statistics of our Civil War and those of the Franco-Prussian War served as a basis for estimating the losses to be expected in future campaigns, but the introduction of more efficient firearms and the result of the experiences in the Russo-Japanese War may compel some revision of our standards. Unfortunately, the completed statistics of the latter war are not yet available, but enough has been given out to indicate that no radical changes will have to be made in the estimates of losses in future campaigns, and it is therefore believed to be still profitable to also review some of the older figures:

The average loss in individual battles was undoubtedly greater in the Russo-Japanese War than in the others mentioned and amounted to 16.7 per cent. for the Russians and 20.4 per cent. for the Japanese, whereas in the campaign of 1870–71 it was only 7 per cent.

Battles	Nation	Strength	Per cent.		Ratio of killed and wounded
			Killed	Wounded	
Shiloh,	Union.....	62682	2.67	13.4	1–4.8
April 6–7, 1862,	Confederate	40335	4.27	19.8	1–4.6
Antietam,	Union.....	56000	3.749	16.93	1–4.5
Sept. 17, 1862,	Confederate	40000	6.7	21.93	1–3.2
Gettysburg,	Union.....	88289	3.57	17.5	1–4.6
July 1–3, 1863,	Confederate	75000	5.2	24.0	1–4.6
Chickamauga,	Union.....	58222	2.8	16.7	1–5.9
Sept. 19–20, 1863,	Confederate	66366	3.4	22.0	1–6.4
Wilderness,	Union.....	101895	2.2	11.8	1–5.3
May 5–7, 1864,	Confederate	61025	.....	.....	.....
Spichern,	German....	28000	2.9	12.7+	1–4.3
Aug. 6, 1870,	French.....	20000	1.6	8.3	1–5.2
Mars-la-Tour,	German....	66300	4.94	15.5	1–3.1
Aug. 16, 1870,	French.....	126170	1.08	8.0+	1–7.4
Gravelotte,	German....	146000	3.04	10.37	1–3.8
Aug. 18, 1870,	French.....	125000	0.9	5.37	1–5.8
Sedan,	German....	165400	0.989	3.91	1–3.9
Sept. 1, 1870.	French.....	108000	2.76+	12.97	1–4.6
Yalu,	Russian	21000	3.0	5.6	1–2
Apr. 30–May 1, 1904	Japanese ..	40966	0.5	2.0	1–4
Liaoyang,	Russian	140000	1.799	9.85	1–5.5
Aug. 26–Sep. 4, 1904	Japanese ..	125000	3.837	14.0+	1–4
Mukden,	Russian	310000	2.9	16.3+	1–5.5
Feb. 23–March 10, 1905.	Japanese ..	340000	4.41	17.64	1–4

The percentages given for the Manchurian campaign are for individual battles which lasted for variable periods of time, from a few hours to several days and even weeks.

For the purposes of comparison and as a basis for estimates of medical department requirements for the future, such battle percentages are not entirely satisfactory. It is of some importance that we should know the proportion of losses for each day's fighting as the wounded are not to be left on the field until the close of an engagement that lasts more than one day. In the Franco-Prussian War most of the 27 battles were fought and decided in one day and several of the Civil War engagements lasted several days, sometimes more than a week. It has been computed that the percentage of casualties for each fighting day during the campaign of 1870–71 for the Germans was 4.7 per cent., for the Russians in Manchuria 1.7 per cent. and 2 per cent. for the Japanese. The percentage for each battle day of our Civil War was probably not far from that of the Germans.

These figures have not, however, such an important bearing upon the medical service as supposed by some, as there is not the slightest foundation for belief that the casualties were evenly distributed throughout the course of long engagements. Some of the great battles in the Russo-Japanese War were fought over a very large space of ground and continued for many days, but there were always intervals in the course of the battles when troops were not actually engaged.

At Mukden, where the operations extended over a period of nearly two weeks, there were not more than three or four fighting days for any one body of troops. The same state of affairs obtained to some extent in many of the battles of the Civil War. At the battle of Gettysburg, for instance, which lasted three days, the same troops were rarely engaged more than one day.

While there is no numerical data to prove that at critical moments during the Manchurian battles (charges, hand to hand fights, etc.), that losses were so high as to equal or even exceed

Material	Penetration inches			
	50 feet	100 yards	500 yards	1000 yards
White-pine butts, made of 1-inch boards placed 1 inch apart.	33.5	46.7	24.3	12.8
Moist sand	8.7	.....	13.4	12.5
Dry sand	4.	.....	9.2	7.5
Loam practically free from sand.	14.	.....	18.8	18.6
Mild steel plate, 0.493 inch thick.	0.446	0.259	.....	
Mild steel plate, 0.3843 inch thick.	Through	Through	.....	
Gun shield steel plate, 0.20 inch thick.	Through	Through		
Thoroughly seasoned oak, across the grain.	12.2	33.6	.....	
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The trajectory and more especially the angle of fall of projectiles as shown in (Figs. 6 and 7) must always be considered when the question of establishing a station within the danger zone from overshots arises. It is easily seen that a site for a station or an evacuation route might be selected, which would be entirely concealed from the enemy's view, but nevertheless as much exposed to his overshots as the obviously exposed high ground in the neighborhood.

As an illustration, let it be supposed that Fig. 8 represents an area of a "two inches to the mile, 20 feet contour interval map," and that the establishment of an aid or dressing station was contemplated at "A." By measuring the distance between the 500 and the 440 feet contour lines, which indicate a fall of 60 feet, it will be found that the slope of fall of a rifle bullet

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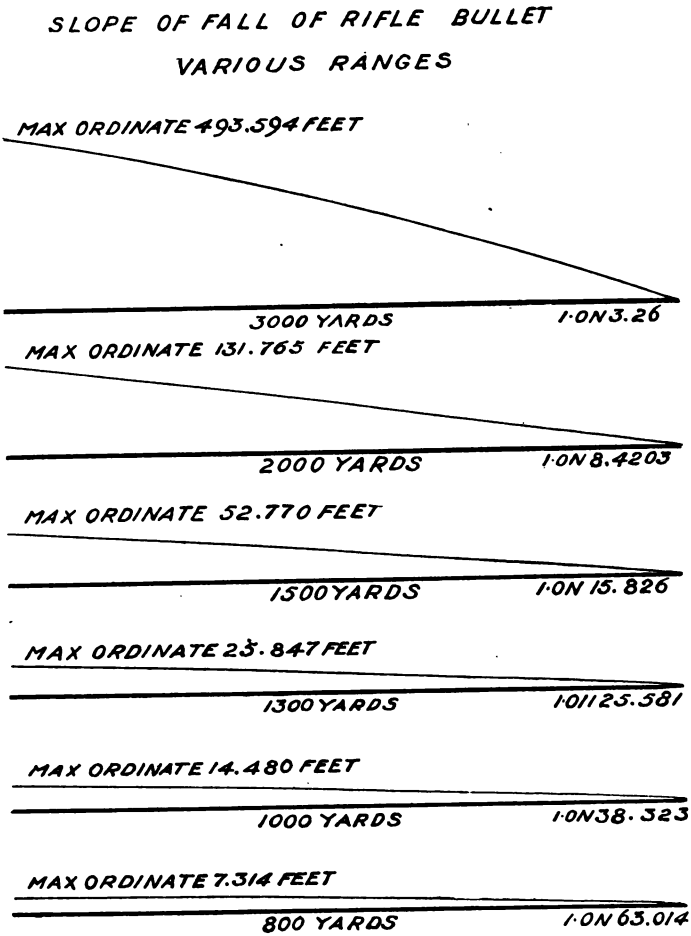
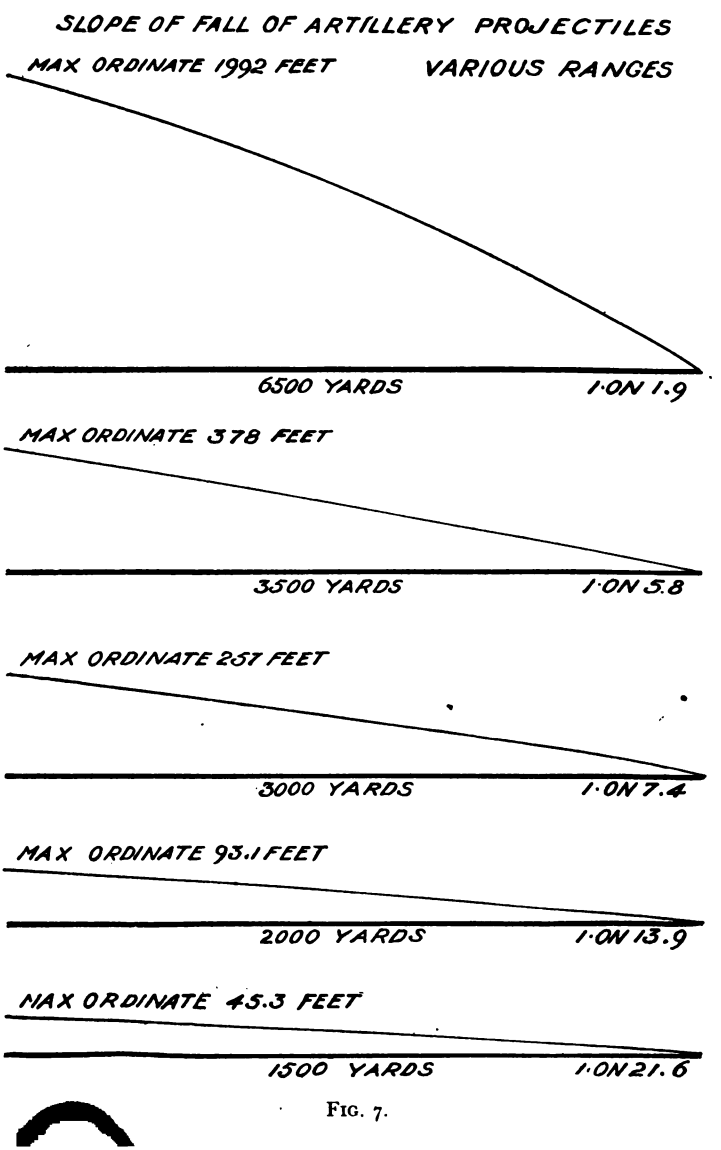


FIG. 6.

point "A" would be as much exposed to overshots as the crest at "B." (The distance between the contour lines at "A" and "B" is approximately 500 feet, and the difference between the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1·ON 21.6

FIG. 7.

categories is also necessary when the attempt is made to estimate the amount of transportation and hospital space that may be needed at the front. The proportion to be included in each class has been variously estimated and some rather extravagant statements have been made in reference thereto. For instance, it was maintained by some that the Manchurian campaign showed that 75 per cent. of all the wounded would be able to reach the dressing stations, field hospitals, or advance base unaided. Authorities have reached no definite agreement as to the probable proportion to be expected in each class in the future. Each has apparently modified the figures obtained from the Far East to meet the probable requirement of his own particular service. The figures here given are believed to be a conservative estimate from our point of view. It must not be forgotten that the state of discipline and training has some influence on the number of wounded that can be compelled to walk some distance.

For working purposes those wounded in battle may be apportioned among four different categories:

1. The very severely wounded that cannot stand transportation, including abdominal wounds and other serious injuries accompanied by marked symptoms of shock. The transportation of such cases to a distance in vehicles would in all probability deprive many of them of their chance of recovery. From a service point of view, such cases are lost to the army, but humanity demands that they be given every possible care and attention. It is questionable if special efforts should be made to prevent such cases from falling into the hands of the enemy. However, wounded must not be lightly left to fall into the hands of the enemy, as the effect that such action would have upon the morale of troops is not to be disregarded. Whenever practicable they should be sheltered near the place of the receipt of their injuries, and, when necessary, left with sufficient personnel and supplies, under the protection of the provisions of the Geneva Convention.

2. The less severely wounded that require transportation by

500 feet and the 440 feet contour lines being 60 feet, the slope of fall of the ground is about one on eight, which practically represents the slope of fall of a rifle bullet fired at 2000 yards).

By reference to the next table it may be determined how large a space would be protected against rifle fire at various ranges by obstacles of certain heights. Such information may be of value when a large dressing station is to be established within the zone of overshots:

Range	Height of obstacle necessary to give cover to a soldier at the following distances in the rear thereof.*					
	10 yards	20 yards	50 yards	100 yards	150 yards	200 yards
yards	feet	feet	feet	feet	feet	feet
500	5.8	6.0	6.4	7.0	7.4	7.6
1,000	6.3	7.1	9.2	12.2	14.6	16.6
2,000	9.1	12.6	22.6	38.4	53.1	65.8
3,000	15.6	25.1	50.6	91.7	131.1	167.8

* Note.—Assumed that line of sight is horizontal and height of man is 68 inches.

CHAPTER II.

PART V.

CASUALTIES.

Before attempting to describe the system for the relief of the wounded on the battle-field it would seem to be quite necessary to inquire into the subject of battle casualties so that some estimate may be made of the losses to be expected and thus give an idea of the task which may confront the medical department.

The study of battle losses is beset with many difficulties and yields only approximate results, for it must be based upon statistics seldom reliable and assume factors which are liable to many and unexpected variations. But in no other way can we obtain the information necessary for calculating the probable needs in personnel, supplies, and transportation of the department.

Until very recently, the carefully prepared casualty statistics of our Civil War and those of the Franco-Prussian War served as a basis for estimating the losses to be expected in future campaigns, but the introduction of more efficient firearms and the result of the experiences in the Russo-Japanese War may compel some revision of our standards. Unfortunately, the completed statistics of the latter war are not yet available, but enough has been given out to indicate that no radical changes will have to be made in the estimates of losses in future campaigns, and it is therefore believed to be still profitable to also review some of the older figures:

The average loss in individual battles was undoubtedly greater in the Russo-Japanese War than in the others mentioned and amounted to 16.7 per cent. for the Russians and 20.4 per cent. for the Japanese, whereas in the campaign of 1870–71 it was only 7 per cent.

can, after some experience in a campaign, be modified to correspond to the actual situation.

For the present purpose the sick are classified as follows:

1. Sick in quarters { Able to do light duty: Class (a)
   Unable to do any duty: Class (b)
2. Hospital cases.. { Slight..... Class (c)
   Severe ..... Class (d)

Class	Daily admission per 1000	Duration of treatment in class	Average number of days in class	Day when maximum number is reached
(a)	3	3 days	3	4
(b)	3	3 to 5 days	4	6
(c)	1.5	5 to 14 days	10	15
(d)	1.5	14 to 50 days	32	51

It would appear from the above table that the maximum number of cases in class (a), for instance, would be reached on the fourth day, and thereafter the admissions and discharges would balance. Discharge from a class does not necessarily mean that the patient was returned to duty, as it includes deaths and transfers to another class, and in the latter case, it would constitute a new admission in the category to which he was transferred as far as these figures are concerned.

CHAPTER II.

PART VI.

TRANSPORTATION.

The Medical Department field service regulations remark upon the difficulties that may be expected in the efforts to relieve the troops at the front of the sick and wounded. It has often been stated that the success of the medical service in the field largely depends upon the celerity with which the command can be relieved of its encumbrance of non-effectives, and many experienced medical officers have expressed the opinion that the future progress of medical organization must necessarily be along the line of developing a more adequate transport and evacuation service. The Manchurian campaign illustrates this necessity in a marked degree and the additional transport material that the contestants were forced to obtain was enormous in comparison to what they had at the beginning. It is recorded that during the last year or two of our Civil War some commands were allowed ambulances at the rate of one for every 150 men and then the supply trains often had to be largely drawn upon after serious engagements. By comparison, the present allowance—one ambulance to about 400 men—seems very small, but there is now authorized a transport column on the line of communication for each division which formerly did not obtain.

It is a foregone conclusion that in a severe battle in which large bodies of troops are engaged the present authorized medical department transportation will prove as pitifully inadequate as in former times, but it must be remembered that armies are put in the field in war time for the purpose of fighting battles and not to exploit humanitarian ideas or medical methods, and that a medical department might easily be made so cumbersome that the greater good that it could then accomplish in the way of better care of wounded would be more than offset by the hindrance it might be to the army in accomplishing its main purpose.

The medical department of a division disposes over a variety of means of transportation for patients and for medical supplies, comprising ambulance wagons, field wagons, litters, pack transport, travois, etc., to which may be added ambulance carts, two mule litters, and motor vehicles.

Means of Transport of Medical Department for Infantry Division.

	Ambulance wagons	Field wagons	Litter squads	Pack mules	Travois
Regimental (12 Reg).....		12	72	12	
Ambulance company (4)...	48	12	64	16	16
Field hospital (4).....		32			
Reserve medical supply....		6			
Totals.....	48	62	136	28	16

Cavalry Division.

	Ambulance wagons	Field wagons	Litter squads	Pack mules	Travois
Regimental.....		10	60	10	
Ambulance company (2)...	24	6	32	8	8
Field hospital (2).....		32			
Reserve medical supply....		6			
Totals.....	24	54	92	18	8

Ambulances, litters, and travois may be considered as being always available for transporting wounded, but it is hardly to be expected under any circumstances that all medical department supply wagons can be diverted to such use. Most of those belonging to established field hospitals and to ambulance companies might be counted on for temporary use in case of emergency. It is also often considered to be practicable to use empty wagons of the supply train of the division—one section of about 50 wagons which must return daily to the advance base for renewal of supplies, provided that it would not be necessary for them to be diverted from their prescribed route of march. The general supply service of an army in the field is of such vital importance to its efficiency, and as it must be carried on with a minimum amount of transport, no serious interference therewith can be tolerated, even in the interest of the sick and wounded.

While there are 475 field wagons allowed an infantry division, yet it would be unreasonable to expect to obtain more than a very small part thereof, and the medical department must be content, perhaps, with the empty supply section referred to. There is, however, still another source from which additional transportation for wounded may be drawn—vehicles belonging to citizens in the surrounding country, and regulations of many services provide for the systematic collection of wagons whenever a battle is imminent, and for evacuating the sick of troops on the march when the usual means are not available.

Chief surgeons are also authorized to hire transportation under such circumstances, and, in some countries, as was the case in Manchuria, it may be feasible to largely extend the transport by hiring litter bearers.

The transport columns that properly belong to the line of communications would probably be largely augmented and might be called upon to assist at the front, when the special military situation permits.

From the above it may be gathered that it is not possible to give definite figures concerning the amount of transport t

might be available in a given instance, but the statements made afford some basis at least for making a reasonable estimate.

For practical purposes and for the solution of medico-military problems it is essential that attempts should be made to determine the capacity of the various means of transport and the amount of work that could be accomplished therewith. Here, again, a great difficulty arises in the effort to fix upon a normal that is to be used as a basis for estimate. The factors concerned are subject to such great variations; the military situation, roads, cover, weather, etc., all must be considered. However, the figures quoted below are, perhaps, the best estimate that can be obtained, and in fact some of them have been practically confirmed by observers in the Russo-Japanese war, who gave special attention to the subject.

The most important element in the plan for the medical service in battle is the arrangements that have to be made for the transportation of sick and wounded, the chief surgeons must make an estimate of the kind and amount of transportation that will probably be required in case a severe battle takes place. The various factors in the estimate given here would probably have to be given other values to meet local conditions and the special military situation, but a knowledge of the plans of the commander and of the topography of the ground would simplify the problem. Formulas have been devised to facilitate such calculations and the figures and formulas given below are quite generally accepted for the purpose:

Litter Transportation.

First aid and loading,	8 minutes
March 1000 yards,	20 minutes
Unloading, delays,	15 minutes
Returning with closed litter,	10 minutes
	53 minutes
	(roughly 1 hour)

Ambulance Wagon.

Four litter cases and one sitting with driver, or nine patients able to sit up may be carried in one load. The average load (recumbent and sitting) of an army field wagon may be taken to be five patients.

Loading 4 recumbent and one sitting,	5 minutes
Driving 2000 yards,	18 minutes
Unloading and exchanging litters,	5 minutes
Return, delays,	10 minutes
	38 minutes

or to calculate the time required with a given amount of transportation to evacuate a certain number of wounded to a designated point.

$$\text{Time required} = \frac{w \times x \times t}{m \times x \times n}$$

To obtain the amount of transportation required in a given time to evacuate a certain number of patients, the following formula may be used:

$$\text{Number of units of transport required} = \frac{w \times x \times t}{T \times x \times n}$$

m = the number of units of transport material (ambulances, wagons, carts, etc.).

T = the time allowed or required.

w = the number of wounded.

t = the time taken by the vehicles used for transport.

n = the number of patients each unit carries.

As an illustration, let it be supposed that 200 wounded are to be transported by the 12 ambulances of an ambulance company from a dressing station to a field hospital located three miles away, and it is desired to know the time necessary for accomplishing the task. From the figures given in the chapter on casualties it would appear that 75 of the 200 wounded requiring transportation would have to be carried lying on li

and the remaining 125 sitting up. By using the second formula the following figures are obtained:

$$\text{Recumbent } \frac{75\times 2}{12\times 4}=3 \text{ hours and 6 minutes.}$$

$$\text{Sitting } \frac{125\times 2}{12\times 9}=2 \text{ hours and 18 minutes.}$$

Total time required 5 hours and 24 minutes.

Should the problem be to ascertain the number of ambulances required to move that number of patients in three hours, the second formula would apply:

$$\text{Recumbent } \frac{75\times 1.5}{3\times 4}=9.3+$$

$$\text{Sitting } \frac{125\times 1.5}{3\times 9}=6.7+$$

Total 16+

17 ambulances would therefore be needed.

The same formulas may also be applied in the case of litter squads. Supposing that it is desired to ascertain the time necessary to move 200 litter cases to a dressing station 2000 yards distant and that the 64 litter squads of the ambulance companies are available for the purpose. Using the first formula, the result would be:

$$\frac{200\times 1.5}{64\times 1}=4 \text{ hours and 40 minutes.}$$

In the same manner the capacity of, or the time required by, trains and boats can be estimated.

CHAPTER III.

ORGANIZATION.

CHAPTER III.

ORGANIZATION.

Although the details of army organization are fully set forth in the Field Service Regulations, it is nevertheless deemed expedient to review some of the leading points thereof preliminary to a special consideration of medical organization.

It is to be noted that the organization of units higher than the regiment is not fixed by law, but is subject to change upon the authority of the President and the War Department. The composition of the larger units varies according to the special necessity. The facts and figures quoted may, however, be considered to express the average or normal organization.

	Company		Battalion		Regiment	
	Officers	Enlisted men	Officers	Enlisted men	Officers	Enlisted men
Infantry.....	3	108	15	440	51	1500
Cavalry.....	3	86	15	351	53*	1188
Field artillery..	5	171	18	531	44*	1126
Engineers.....	4	(100)† 164	15	(309)† 501		
Signal troops...	4	100	11	(150)† 207		

* Includes 2 veterinarians.

† Mounted.

In computing the strength of divisions and field armies the civilian clerks and drivers are included as they are entitled to the same medical care and attention in the field as the enlisted personnel.

The company and regiment are both administrative and tactical units. Battalions and brigades are, as a rule, tactical only, and the staff of a brigade commander usually consists of a brigade adjutant and two aides only.

A normal brigade consists of the headquarters and three regiments of infantry—approximately 4740 officers and men (sanitary troops included).

The division comprises 19,850 officers and men, including sanitary troops and civilian drivers and clerks and are distributed among organizations as follows:

TABLE NO. 1.

The Division.

Organizations	Officers*	Enlisted men	Civilians	Totals
Division headquarters	12	9	13	34
Three brigades infantry (9 reg.)	498	13716	6	14220
1 regiment cavalry	57	1212	.....	1269
1 brigade field artillery (2 reg.)	95	2294	2	2391
1 pioneer battalion (3 Co.)	18	510	.....	528
1 field battalion signal troops (2 Co.)	13	213	.....	226
4 ambulance companies	21	318	.....	339
4 field hospitals	21	230	.....	251
Service of Supply.				
Officers and assistants	13	8	35	56
Ammunition train	2	8	180	190
Supply train†	2	15	216	233
Bakery train	.....	.....	99	99
Pack train	.....	.....	14	14
	752	18533	565	19850

* Inclusive of medical officers, chaplains, and veterinarians.
† Inclusive of medical reserve supply.

Cavalry Division.

Organizations	Officers*	Enlisted men	Civilians	Totals
Division headquarters	12	9	13	34
3 brigades (9 reg.)	516	10908	6	11430
1 reg. horse artillery	47	1147	.....	1194
1 pioneer battalion (3 Cos. m'td)	18	318	.....	336
1 field battalion, signal troops (2 Co).	13	213	.....	226
2 ambulance Co.	10	158	.....	168
2 field hospitals	10	114	.....	124
Service of Supply.				
Officers and assistants	9	8	36	53
Ammunition train	2	8	108	118
Supply trains †	2	15	108	125
Pack trains (2)	.....	.....	28	28
Totals	639	12898	299	13836

A field army is the next higher field organization and is composed of two or more divisions, to which ordinarily may be added a cavalry division and an auxiliary division. This unit takes the place of the army corps formerly authorized. The organization of the auxiliary division depends so much upon the special situation that only an estimate can be made of its probable strength.

* Includes medical officers, chaplains, and veterinarians.

† Includes medical reserve supply.

An Auxiliary Division.

For a field army composed of two infantry divisions and a cavalry brigade (estimated):

Organizations	Officers	Enlisted men	Civilians	
Headquarters	11	9	18	
1 regiment infantry	55	1524		
1 regiment heavy artillery	47	1147		
1 battalion horse artillery	19	540		
1 ponton battalion	18	510		
1 aero-wireless battalion	13	213		
Supply service	4	8	19	
1 ammunition train	1	4	68	
1 supply train	1	4	102	
1 ambulance company	5	79		
1 field hospital	5	57		
Totals	179	4095	207	
Grand total				4481

Two or more field armies may, upon the authority of the President, be combined to form an *army*. The headquarters staff thereof will be such as may be deemed necessary by its commander.

A field army composed of 2 divisions, a cavalry brigade and an auxiliary division, would constitute a force of about 47,466 officers and men, distributed as follows:

Organizations	Officers	Enlisted men	Civilians
Headquarters	20	11	3
2 divisions	1504	37066	1130
1 cavalry brigade	172	3636	2
1 auxillary division	179	4095	207
Totals	1875	44808	1342
Grand total			48025

The line of communications corresponds to the medical evacuation zone and is the route on which troops and supplies are sent from the base to the zone of operation and sick and wounded are evacuated to the rear. A line of communications is established for each field army or important expeditionary force and is under the control of their respective commanders, and directly under a commander who controls over the troops therein and such number of staff officers as may be necessary.

Medical Department Organization.

Important changes have been made in the organization of the medical department of troops in the field in the new Field Service Regulations. It will be observed that the number of medical officers attached to regiments has been increased from three to four, two have been added to each ambulance company, and the latter organization no longer constitutes a section of

the field hospital, but is now a separate unit. The position of brigade surgeon has been abolished except in the case of brigades acting independently and a director of field hospitals and a director of ambulance companies have been added to the division organization. The latter mentioned authorities perform the functions of a battalion commander in a general way, but neither the four divisional ambulance companies nor the four field hospitals are to be considered as administrative units.

No special organization is provided to establish the station for slightly wounded, but the personnel therefor is to be drawn from the sanitary personnel of regiments or trains.

The total number of medical officers of a division has been increased from 81 to 101.

The regimental detachment of the hospital corps of infantry and cavalry regiments has been increased from 3 non-commissioned officers and 9 men to 4 non-commissioned officers and 20 men, and artillery regiments (consisting of two battalions) are allowed 3 non-commissioned officers and 18 men. Ambulance companies are given two additional orderlies for medical officers. The number of non-commissioned officers and men of the hospital corps of a division has been increased from 711 to 877.

The personnel of the medical department are collectively called *sanitary troops*.

Field Service Regulations do not prescribe the number and rank of the staff officers of an *army*, but it is to be presumed that it will conform to that of a field army, except that the staff officers will be of higher grade.

The sanitary personnel of the headquarters of a *field army* include:

1 Colonel, chief surgeon.
1 Colonel inspector.
2 Majors, assistants.
2 Sergeants, 1st class, clerks.

9 Privates, 1st class and privates, orderlies and drivers.
1 Ambulance company.
1 Field hospital.

Of a division:

1 Lieut.-colonel, chief surgeon.
1 Lieut.-colonel, inspector.
1 Major, assistant.
1 Captain, assistant.
1 Sergeant, 1st class clerk.
6 Privates, 1st class or privates, clerks and orderlies.

The sanitary troops of a division are divided into those assigned to regiments or other organizations and those formed into independent sanitary units, such as ambulance companies and field hospitals as shown below:

Sanitary Personnel with Regiments and Battalions.

Organization	Majors	Captains or lieutenants	Total commissioned	Sergeants 1st class	Sergeants	Privates 1st class and privates	Total enlisted
Infantry or cavalry regiment..	1	3	4	1	3	20	24
Field artillery reg.....	1	2	3	1	2	18	21
Engineer battalion (3 cos.)...	....	3	3	....	3	6	9
Signal battalion (2 cos.).....	....	2	2	....	2	4	6

Medical Department Units.

Ambulance co.....	....	5	5	2	7	70	79
Field hospital.....	1	4	5	3	6	48	57
Reserve medical supply.....	....	1	1	1	1	9	11

Total Sanitary Personnel and Transportation of a Division and a Cavalry Division. (Par. 33, F. S. R.)

(a) Division.

	Personnel									Transportation		
	Lieutenant-colonels	Majors	Captains and lieutenants	Total commissioned	Sergeants 1st class	Sergeants and corporals	Pvts. 1st class and privates	Total enlisted	Grand total	Ambulances	Wagons	Pack animals
Division Hq.	1	1	1	3	1	....	6	7	10	..	..	..
Inspection	1	..	....	1	..	1	1	2	3	..	..	..
Infantry, 9 regs.	....	9	27	36	9	27	180	216	252	..	9	9
Cavalry, 1 reg.	....	1	3	4	1	3	20	24	28	..	1	1
Artillery, 2 regs.	....	2	4	6	2	4	36	42	48	..	2	2
Engineers, 1 bn.	....	..	3	3	..	3	6	9	12	..	..	..
Signal troops, 1 bn.	....	..	2	2	..	2	4	6	8	..	..	..
Ammunition train	....	..	2	2	1	1	6	8	10	..	..	..
Supply train.	....	..	1	1	..	1	3	4	5	..	..	..
Ambulance cos. (4).	....	1	20	21	8	29	281	318	339	48	12	16
Filed hosp. (4)	....	5	16	21	12	25	193	230	251	..	32	..
*Reserve supplies	....	..	1	1	1	1	9	11	12	..	6	..
Total	2	19	80	101	35	97	745	877	978	48	62	28

(b) Cavalry Division.

Division Hq.	1	1	1	3	1	....	6	7	10	..	..	..
Inspection	1	..	....	1	..	1	1	2	3	..	..	..
Cavalry, 9 regs.	....	9	27	36	9	27	180	216	252	..	9	9
Horse Artillery, 1 reg.	....	1	2	3	1	2	18	21	24	..	1	1
Engineers bn. (m'nted)	....	..	3	3	..	3	6	9	12	..	..	..
Signal bn.	....	..	2	2	..	2	4	6	8	..	..	..
Ammunition train	....	..	2	2	1	1	6	8	10	..	..	..
Supply train.	....	..	1	1	..	1	3	4	5	..	..	..
Ambulance cos. (2)	....	..	10	10	4	14	140	158	168	24	6	8
Field hosps. (2)	....	2	8	10	6	12	96	114	124	..	16	..
*Reserve supplies	....	..	1	1	1	1	9	11	12	..	6	..
Total	2	13	57	72	23	64	469	556	628	24	38	18

* With supply train.

SANITARY TROOPS AND TRANSPORTATION OF A FIELD ARMY.

(Approximately 48,025 officers and men.)

Organizations	Colonels	Lt.-colonels	Majors	Captains or lieutenants	Total commissioned	Sergeants 1st class	Sergeants	Pvts. 1st class and privates	Total enlisted	Ambulances	Wagons	Pack mules
Headquarters	2	..	2	....	4	2	....	9	11	1	1	....
2 divisions	..	4	38	160	202	70	194	1490	1754	96	124	56
1 cavalry brigade	..	..	3	9	12	3	9	60	72	....	3	3
Auxiliary division	..	..	5	24	29	9	27	190	217	12	13	6
Totals	2	4	48	193	247	84	230	1749	2054	109	141	65

No attempt is made to give a detailed organization and strength of the troops to be employed on the line of communication and it is impracticable to even attempt to make an estimate as the length and character of the line, as the military situation determines the organization and force to be used, nor is it a matter of great importance, as far as the medical service is concerned, because the medical organization is largely based upon the strength of the field army or large expeditionary force which the line of communications is to serve.

The medical department of the line of communications is headed by a chief surgeon with one or more medical officers as assistants and a number of non-commissioned officers and privates of the hospital corps as clerks and orderlies. A sanitary inspector is also assigned to the headquarters staff. One or more consulting surgeons and sanitarians, specially qualified volunteer medical officers of high rank, but who have no administrative responsibility, may be added as professional consultants and advisers.

The medical organization comprises:

Transport columns
Evacuation hospitals.
Base hospitals.

Supply depot.
Hospital trains.
Hospital boats.
Red Cross relief columns.

One transport column, two evacuation hospitals, one base hospital, and one supply depot is allowed for each division comprising the field army served by the line of communications, and hospital trains and boats may be added whenever desirable and practicable.

The Red Cross organizations are used to supplement the regular institution and to assist in the care and transportation of sick and wounded on the line of communications and at home and are not usually called upon for service in the zone of operations. They also establish rest and food stations whenever necessary on the line of communications or further in rear.

Personnel and Transportation of Sanitary Organizations on Line of Communications.

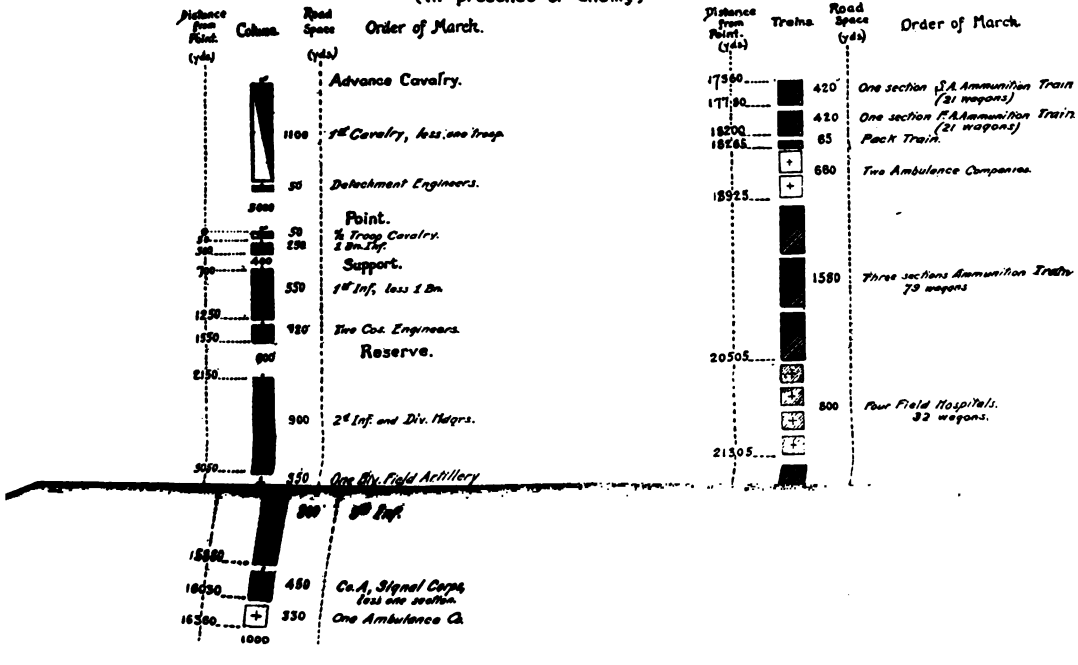
Organization	Colonels	Lt.-colonels	Majors	Captains and lieutenants	Total commissioned	Sergeants 1st class	Sergeants	Pvts. 1st class and privates	Total enlisted	Female nurses	Ambulances	Wagons	Cars	No. of beds
Transport column	..	..	1	1	2	2	8	32	42	..	12	1	..	....
Evacuation hospital	..	1	..	13	14	8	16	129	153	..	3	2	..	324
Base hospital	1	..	1	18	20*	8	16	129	153	46	3	2	..	500
Supply depot	..	..	..	2	2	1	2	12	15	..	..	..	..	....
Hospital train	..	..	..	3	3	1	2	24	27	..	..	..	10	200
Hospital ship	..	..	1	4	5	1	4	35	40	..	..	..	..	200
Red Cross							Not fixed							

* Including 1 dentist.

PLATE I

Road Space of an **INFANTRY DIVISION** on a single road.

(In presence of enemy)



endeavor to make the necessary arrangements whenever at all practicable.

ntal medical supply wagon and pack mule, the d wagons of the ambulance company, and the wagons of the field hospital bear the same relats as the combat trains. The regimental medical as a rule, will be assigned to the field trains when ıe march.

hing in the presence of the enemy, the ambulance ı their ambulances may be incorporated in the ıps or when they are required to proceed with ıtion only (pack mules), the ambulances march ıdvance of the field trains. Ambulances may ıted among the various regiments in the column, :act with the enemy is imminent they will be d.

companies and field hospitals generally march division field train, but if an engagement is in vill usually precede it.

:rve medical supply wagons formerly referred to ıs the advance medical supply depot, march with n.

ws the order of march and the road space occuion with its trains, marching on a single road in the enemy.

CHAPTER IV.

ADMINISTRATION.

CHAPTER IV.

ADMINISTRATION.

The medical department of an army in the field has four functions, viz.:

1. Sanitation.
2. Professional care and treatment of sick and wounded.
3. Providing medical and hospital supplies.
4. Collection and evacuation of sick and wounded.

This discussion will be largely confined to the service indicated in the fourth heading—the collection and evacuation of the sick and wounded from the zone of operations; in other words, to such duties as cannot properly be classed under the head of sanitation or other strictly professional subjects. It relates almost exclusively to administrative functions which have as their ultimate object to bring the patient, the facilities for his treatment, and the surgeon in conjunction under the most favorable possible circumstances. That and the supervision of sanitation is what is largely implied when the administrative duties of medical officers are mentioned. From a strictly military point of view, such duties are of the greatest importance, and an efficient service of this kind not only enhances the mobility of troops by relieving them of the encumbrance of sick and wounded, but incidentally increases the effectiveness of a force by preventing spread of infectious disease at the front and also by the good effect the removal of the sick and wounded has upon the morale of troops.

Baron von Schellendorf, in his "Duties of the General Staff," pointedly remarks that "the system of evacuating sick (and wounded) forms the basis of the entire medical service in the field." In practice, it will not be possible, however, to separate

this service from that given under the second and third head, as patients will need care and treatment and certain medical supplies while in process of being taken to the institutions in the rear.

The service of the evacuation of the sick and wounded naturally falls into three well-marked zones:

(a) Collecting.
(b) Evacuating.
(c) Distributing.

The first, or collecting zone, corresponds to the zone of active operations; the second, or evacuating zone, to the lines of communication, and the third to the home territory. No very distinct line of demarcation can, however, be drawn between the different zones as they are bound to overlap more or less. Consequently an article of this kind, which purports to deal with the service at the front, must also give some consideration to that of the line of communications.

The various organizations of sanitary troops that are provided for the purposes noted above in the three zones are as follows:

Collecting Zone:

1. Regimental detachments.
2. Ambulance companies.
3. Field hospitals.
4. Reserve medical supply trains.

Evacuation Zone:

1. Transport columns.
2. Evacuation hospitals.
3. Sanitary supply depots.
4. Hospital trains and boats.
5. Base hospitals.
6. Base supply depots.

Distributing Zone:

1. Hospital ships and trains.
2. General hospitals.
3. Supply depots.

The service of the three zones is supervised and co-ordinated by the surgeon-general of the armies in the field under the superior direction of the Surgeon-General of the army.

Chief surgeons exercise general supervision and control over the entire medical service of their respective commands, including sanitation, care and treatment of sick and wounded, proper supply of all medical department units, and relieving the army of non-effectives.

The responsibility for the evacuation service rests with the chief surgeon of the *army* who gives general instructions to chief surgeons of field armies, who, in turn convey them as a whole or in part to division surgeons, and to chief surgeons of lines of communication. Chief surgeons of field armies and division surgeons are the two authorities more directly concerned in devising the detailed plans or schemes for use of medical department units at the front. Chief surgeons are members of the staffs of their respective commanders and are expected to advise the latter upon all matters pertaining to their particular service, and under par. 291 F. S. R. may be authorized to issue orders to their subordinates in the name of the commander. They must keep themselves constantly informed of the military situation and of the plans and intentions of their commanders in order that timely preparation may be made for projected movements and operations.

The Division Surgeon.

The division is the great administrative and tactical unit and forms the basis of army organization. It follows that the division surgeon is in a corresponding position of great responsibility, and under the direction of his commander and of the chief surgeon of the field army, supervises and controls the entire sanitary service of his division, in camp, on the march, and in battle. Based upon the instructions received from the chief surgeon of the field army and a knowledge of the situation as communicated to him by his commander or chief of staff, he must devise and carry out a plan for a systematic evacuation of

non-effectives and for the proper use of medical department units. To assist him in administering the medical affairs of the division, he disposes over the services of the inspector, directors of field hospitals and ambulance companies, and two medical officers specially detailed for duty in his office.

The division surgeon must arrange a systematic and orderly service for the care and disposal of the sick on the march and must be prepared to give definite instructions to accomplish this result.

The place or places where the sick are to be assembled and whence they are to be sent to a hospital for treatment should be designated, upon the recommendation of the division surgeon, in par. 4 of march and camp orders. The details of the method to be pursued, the designation of the personnel and transportation, the time and place when the latter are to rejoin the column, etc., must be provided for in special orders and instructions.

Unless the entire division is compactly camped, it is usually advisable to fix upon an assembly point for each brigade to which patients are brought by ambulance or litters. As these collecting places are not usually expected to continue in function more than a few hours at the most, no considerable personnel is needed to serve them, and one medical officer, a non-commissioned officer, and a few men are amply sufficient for each place. The personnel may be taken from a field hospital or ambulance company or from a regiment marching near the head of the column so that a place may be prepared for such patients as may fall out during the day's march.

The division surgeon, being in constant touch with the chief surgeon of the line of communications, would at once notify him of the number of cases that will require transportation to the rear so that immediate steps may be taken to remove them.

In the attempt to maintain the highest possible effective strength, much work and responsibility is thrown upon the medical department and the division surgeon must impress upon the regimental medical officers the urgent necessity of pursuing a rigorous policy in the selection of cases for evacuation.

Patients falling out during the march and those reporting at sick call are to be classified in three categories:

1. Trivial cases that may be expected to recover in a few days.

2. Severer cases that must be sent to the rear.

3. Non-transportable cases that must be provided for at the place.

(1) To prevent undue depletion of the ranks, it is important that patients whose disability will probably only be of very short duration should be kept with the command, except when troops are marching into action. It is a matter of common experience that much is lost in effective strength of a marching command if trivial cases are sent to institutions in the rear, especially in the case of raw troops, many of whom find the hardships and restraints of active service irksome and are inclined to take advantage of every pretext to escape therefrom.

Some of the lighter cases may well be able to march, if relieved of their packs, and the others can be carried in ambulances and on the wagons of the trains.

(2) The severer cases and such others as cannot be expected to recover soon must be directly or indirectly turned over to the medical department on the line of communications. They are to be assembled and taken care of until they can be turned over to a transport column or other line of communication organization, or they may be sent to the rear in the empty supply wagons returning to the advance base and by hired transportation.

Ambulance companies should not be called upon for such service if the command is in the proximity of the enemy.

(3) The non-transportable cases, which might include infectious cases, are to be directly turned over to the sanitary troops of the line of communication. Should it be impracticable to thus dispose of them at once, it may be necessary to leave a medical officer and the necessary attendants for their temporary care or it may be advisable to turn them over to a neighboring civil institution.

Daily orders and instructions must be issued, not only to fix the assembly points, the details of men and transportation, but also when the latter may rejoin their commands if there is delay in transferring the patients.

Like any other extensive operations, the medical service of a division in battle must be conducted in accordance with a well-defined plan which is to be formulated by the division surgeon and approved by the commander. This plan must also be thoroughly understood by all that are concerned in its execution.

The division surgeon being the highest medical authority that directly supervises the medical service of a division in battle, would undoubtedly be called upon to submit his recommendation to the commander or chief of staff when the battle order is to be issued. Some of these recommendations may be included in the body of the order, others would be formulated as special orders for the guidance of the medical department alone.

The division surgeon's plans for the battle service are based upon the information and instructions received from the commander of the field army or his chief surgeon, including the reports from the authorities on the line of communications concerning the preparations made for the transportation and reception of the sick and wounded, and the quantity and availability of the supplies on hand. Furthermore, he must have informed himself of the character of the ground upon which the engagement is to take place, either by personal inspection or by a careful study of the map. He must select, at least, tentative locations for the stations and routes for the evacuation to the rear, and the routes and means by which additional medical and surgical supplies may be sent to stations when needed.

The instruction that he expects to receive from the chief surgeon of the field army would probably cover the following points:

1. The evacuation of the sick that may have accumulated up to the time when the troops go into action, their destination and the route by which they are to be sent.

2. The location and capacity of the hospitals that may have been designated to receive the wounded of the division and the route thereto. The number of evacuation hospitals that could be advanced to the vicinity of the battle-field for the relief of the field hospitals.

3. The kind and amount of transportation that can be furnished from the line of communications for the evacuation of the wounded of the division.

4. The place to which the slightly wounded that are able to march are to be directed.

5. The places along the line of evacuation where it is proposed to establish rest stations.

6. The location of the supply depots and the arrangements made to furnish additional hospital supplies and renewal of materials expended during action.

When a battle is imminent it becomes necessary that the troops who are to participate therein should be relieved of all non-effectives and that the medical institutions that may have been established in the zone of operations or on the line of communications be cleared of patients in anticipation of the large number of wounded that would in all probability soon require care and attention.

In addition to the daily quota (page 50) of severer cases that would ordinarily have to be sent to the rear, a large proportion of those usually treated in "quarters" would also have to be evacuated, as their presence under such circumstances would be a hindrance to the mobility of troops and also place additional burden upon the medical and supply departments.

The division surgeon would designate an ambulance company to perform the duty of collecting them, but some other means of transportation to the rear would have to be provided, as the ambulance companies would probably soon be needed on the field. In the absence of any special arrangements made by the chief surgeon of the line of communications, the empty supply section returning to the advance base might very properly transport such patients.

In making his plans for the battle service, the division surgeon must know where the wounded will be sent, the route thereto, and when the designated institutions will be ready to receive them. Presumably evacuation hospitals will be established at the advance base or some still more convenient point, or arrangements may have been made to transport the wounded by train or boat from some station easily accessible from the battle-field. The military situation and the means of transportation at the disposal of the chief surgeon of the line of communication may permit him to advance hospitals to the vicinity of the battle-field.

Although the responsibility for the evacuation of field hospitals and the transportation of patients to the rear rests with the latter-named authority, it is still necessary for the division surgeon to be fully informed of the preparations made, as he would then be able to give the necessary directions to guide the convoys of slightly wounded and to take advantage of any available transportation to relieve the field hospital from too much overcrowding. Such information would also be useful to him in determining the location of field hospitals, which should be convenient to the evacuation route.

In case of emergency the chief surgeon of the line of communication would be expected to provide transporta ion from that furnished for other purposes or by hiring vehicles from civilians, in addition to the transportation allowed by regulations to transport columns. Should there be a convenient rail- or waterway, trains or boats would be used and this would make the transport problem very much simpler than when only wagon transportation to the advance base was to be relied upon.

The destination of the "sick in quarters" that may have to be sent to the rear and of the slightly wounded must also be specially designated, as it is undesirable that such cases should be sent far back with the severe cases that cannot reasonably be expected to return to the ranks soon.

A knowledge of the location of the proposed rest stations is of assistance to the division surgeon in formulating his instruc-

tions for the service and the evacuation of the collecting station for slightly wounded.

The sanitary supply depot, usually located at the advance supply depot, would be expected to renew the supplies expended during action and such additional material as may be necessary for the wounded that may have to remain some days in field hospitals, and the reserve medical supply wagons from the train would be sent there as soon as emptied.

Upon this information and a knowledge of the intentions of the commander, the division surgeon may formulate a scheme for the speedy rescue of the wounded and for relieving the force of its encumbrance of sick and wounded that might seriously interfere with the subsequent movements of the army. He submits to the chief of staff recommendations concerning the following points, which he desires to have included in paragraph 4 of the division field orders:

1. The time and place where the sick of the command are to be assembled for transportation to the rear.

2. The location of the collecting station for slightly wounded.

3. The location of dressing stations and field hospitals whenever it is possible to fix them in advance.

4. The assignment of additional transportation for the wounded from the field train.

5. The disposition of the remaining medical department divisional units until they may be needed on the field.

It is believed to be quite essential that the above-mentioned points should be covered in the division field orders, for the reason that they are not only of importance to the medical department, but to every member of the command.

The great advantage of a systematic and co-ordinated service appeals to everyone, and that it may rest upon a firm foundation the plan should be confirmed in the orders that give the greatest assurance that every organization will be reached.

The medical department possesses no such rapid and reliable means of communication as that afforded by field orders from division headquarters.

Some central point or points should be designated, as the place where the sick are to be assembled, which place or places should be convenient to the evacuation route and where the empty train wagons may conveniently pick them up. It is suggested that the site selected for the slightly wounded station might serve as the assembly point for the sick, as it would, in all probability, be possible to get rid of the sick before the influx of wounded began.

If the collecting station for slightly wounded is known to the entire command, the straggling of wounded over the country in rear of the line would be largely prevented, and the desire to accompany wounded comrades to the rear restrained, if it was definitely known where proper assistance might be had.

While it is not generally considered advisable to direct the definite establishment of dressing stations and field hospitals before an engagement begins, except perhaps, in defense of strong positions, it may often be expedient to order the establishment of one of each of these institutions early in the action so as to provide for those wounded in the development thereof, and, as suggested above, to prevent the wounded from straggling over the field in search of assistance.

The additional transportation assigned to the medical department from trains, etc., should also be provided for in field orders so that there may be no difficulty or misunderstanding between medical officers and those in charge of the vehicles.

The place where the divisional medical units are held until the necessity arises for their use is also considered to be of sufficient importance to the entire command to warrant mention in the order.

The additional steps that are to be taken may be made the subject of special orders and will be indicated in the discussion of the medical department stations and lines of assistance.

CHAPTER V.

BATTLE DISPOSITIONS.

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Every improvement in firearms has brought about a corresponding change in the style of tactics used by fighting troops, and every modification of tactics has had its influence upon the sanitary service in battle, which has for its object the speedy rescue and care of the unfortunate victims of the enemy's bullets.

Many years ago, during the time of Frederick the Great, troops advanced into battle, shoulder to shoulder, to within 200 yards of the enemy and sought to overcome him by superiority of fire, and the contestant that could fire most rapidly had the best chance of being successful. Open ground was chosen by preference and the rescue of the wounded during the progress of the engagement was out of the question. "Flying field hospitals" were provided which remained with the baggage until the conclusion of the action, when by the aid of troops detailed as bearers, the wounded were collected and cared for. If the action lasted until late in the day the wounded were often left on the field until the following morning.

As a result of an improvement in firearms and the experience gained therewith in our War of Independence, the so-called "linear tactics" were abandoned and troops were not massed as formerly and were taught to take advantage of the cover afforded by the ground. It then became practicable to establish stations for the relief of the wounded somewhere near the battle lines, and the sanitary service in the field assumed greater importance, and surgeons and their assistants were thereafter expected to remain in closer touch.

As the range and efficiency of weapons increased and armies became larger, the difficulties of the medical service increased

in proportion to the number of wounded to be cared for and the extent of ground to be covered in assembling them.

Until after the Civil War and the Franco-Prussian War it was the universal practice to put the first line of assistance well beyond rifle range. In the campaign of 1864 it was often provided in orders that the "ambulance depots," which performed the functions of our present aid and dressing stations, should be placed 500 yards in rear of the line. In the Franco-Prussian War the aid stations were often placed as far as 3000 yards in rear of the line, but it was observed that very few wounded made their way to the distant stations as most of them preferred to conceal themselves in safe places nearer the line.

With the introduction of the small-caliber magazine rifle and the long-range rapid-fire field-piece, it became quite evident that if the wounded were to receive speedy attention, the old plan of placing all medical department stations beyond the range of rifle fire was utterly impracticable, and it is now an accepted fact that, whenever the terrain permits, the work of the rescue and care of the wounded must begin within the danger zone and during the course of the engagement. The large size of modern armies, with a corresponding increase in the number of casualties and the longer duration of battles, makes it absolutely necessary that the business of relieving the distress of the wounded should begin at the earliest practical moment.

It must be admitted, however, that a medical service in war is not organized and maintained with the sole object of meeting the humane demands of the age, that the sick and wounded soldier shall receive the same care and speedy medical attention that patients are accustomed to receive at their homes or in civil hospitals. The basis of the organization of the medical department for war is the military necessity of maintaining the highest possible effective strength of an army and of relieving it of its encumbrance of sick and wounded. The first purpose is accomplished, as far as battle service is concerned, by the early treatment of wounded, especially those who may be expected to recover and resume duty within a short period of time, and

by sustaining the morale of troops by assuring proper care of the unfortunate wounded; the second, by rapidly evacuating all non-effectives from the zone of operations, thereby enhancing the mobility of the army. While all this would seem to be an argument for beginning relief work and establishing stations at the earliest possible moment, it must not be forgotten that at the beginning of a battle there is always more or less uncertainty as to the manner and direction in which the engagement will develop and as to where the sanitary service will be most needed. The division surgeon must, therefore, act with much caution and not order the establishment of stations until the military situation permits of its being done with reasonable safety and the number of wounded on hand justify the measure. In an attack, for instance, an early establishment of aid and dressing stations would expose them to the danger of being left so far in rear as to make it impossible for them to properly fulfill their functions.

There is still some conflict of opinion as to the distance from the line of battle that stations should be established. It is still maintained by some that they should always be beyond the range of fire, but if such statements are inquired into it will usually appear that reference is had to some particular campaign which took place upon ground that afforded but little natural cover. Many reports from the war in Manchuria indicate that dressing stations and field hospitals were often located miles in rear of the line, but in nearly every case a special reason therefor can be discovered, such as the fact that the engagement took place on flat ground or a retreat was anticipated, etc.

It is sound in principle to establish the stations *as near the front as the terrain and the military situation will permit.* It is a mistake to endeavor to fix a definite distance from the line for the location of stations and it must necessarily be determined in each case by the division surgeon, whose knowledge of the situation obtained at division headquarters enables him to act with judgment and proper discretion.

The increased range and efficiency of modern weapons

has also made the work of the sanitary department much more difficult and arduous, the danger zone behind the line having become so extended that the collection and evacuation of the wounded from the field has become a great problem. It is manifestly impossible under ordinary conditions of terrain to traverse the length of the danger zone to bring surgical assistance and to carry away the wounded without being exposed to even greater risk than that of the combatants, consequently if the wounded are not to be allowed to remain a long time on the field without surgical assistance, advantage must be taken of cover within the danger zone.

The experience in recent wars has illustrated both the importance and the difficulties of the sanitary service and an increase in personnel and transportation facilities has recently been provided for our own and most foreign armies. The value of this service as a military factor is also being recognized, since it has become known how large a proportion of wounded will recover quickly and be able to return to the ranks, and that prompt and convenient surgical assistance restrains men from leaving the firing line to assist wounded comrades.

The chief surgeon of a field army can only outline a general scheme for the sanitary service on the field of battle and it falls within the province of the division surgeon to regulate the details of the service within his particular sphere of action. While centralization of authority is one of the fundamental principles of the military institution, it has its limitations, beyond which it is not safe to proceed. It might be added, however, that the limits of centralization are, in a general way, measured by the executive ability of the chief. The chief surgeon of an army cannot supervise the details of a service that may be spread over a large area, and some latitude must be allowed minor authorities. The division surgeon is, therefore, made directly responsible for the way in which the service within his division is carried on, and he must obtain or, when properly authorized, issue the necessary orders concerning the establishment of stations and field hospitals and the routes to be used for evacu-

ating the wounded from the field. Concerted action of all the divisional units is essential to a successful service, and it remains with the division surgeon to effect the necessary co-ordination.

It is to be strongly emphasized that it is not possible to formulate fixed rules for the disposition and location of the sanitary organization on the battle-field anymore than it is practicable to reduce battle tactics to hard and fast lines.

The type of the engagement, the character of the terrain, and the evacuation facilities, all have an important bearing upon the sanitary service on the battle-field, and the division surgeon must give them due consideration in formulating his plan for the relief of the wounded.

It is easily understood that the scheme must correspond in a general way to the tactical movements of troops as employed in a rencounter, planned attack, or defense.

Rencounter (collision of two hostile forces in movement) may develop suddenly and unexpectedly. The enemy's strength, the extent of his lines, and the ground which he occupies are probably not definitely known, and troops are put into action as they arrive on the field and no well-defined plan of action can be determined upon until the strength, position, and purposes of the enemy are developed.

In a planned attack the conditions are much different, the enemy's position, his probable strength, and the extent of his lines have already been determined. The weakest point or points in his line may have been discovered and the place where the main attack is to be made has been decided upon and orders issued accordingly.

Owing to the increased efficiency of modern firearms, troops will not be able to approach each other as quickly and closely as was formerly the case, and a decision may be reached at longer ranges. Even though it were possible for a part of the line at least to get near the enemy's position by taking advantage of cover afforded by the ground, it would sooner or later become exposed to a very effective fire, as the troops on the defensive would certainly choose a position that would at least afford

several hundred yards of open ground on its front. It would be a rash commander who would attempt to cross such a space against anything like an equal force, for if his advance was checked, his force would be in danger of annihilation whether he held his ground or retreated. In any event, even if successful, the losses would be enormous. In fact, a large open space in front of a strong defensive position is generally considered to be an almost insuperable tactical obstruction.

If the terrain and the military situation is unfavorable to a frontal attack, the line may be held by a weaker force and the attempt made to flank or envelop one or both wings of the enemy. The latter course would involve extensive tactical movements that require much time for their execution, which probably explains the long duration of some of the battles in the recent war in Manchuria. It requires much time to move a large force, as not only the troops, but the ammunition, supply, and sanitary trains must be taken along. Nor can a frontal attack be carried out so rapidly as was the case when shorter-ranged weapons were used or as is usually done in maneuvers. The assailants, as soon as they arrive within the range of the enemy's guns, can only advance in rushes by taking advantage of the cover afforded by the ground, and only after a certain superiority of fire has been attained by the aid, perhaps, of artillery. After the line has arrived within five or six hundred yards of the enemy's position, a delay of some hours may still be occasioned until it may be determined if the enemy has been sufficiently overcome to permit of the final advance.

The defender has the advantage of position and can begin an effective fire at a greater distance than the aggressor, as he is able to accurately determine the range of any point visible from his position. The difference in the size of the respective targets afforded by the contestants becomes more and more accentuated as the lines approach and the aggressors expect to sustain much greater losses. Nothwithstanding, the defensive is the less favorable position, as it must be prepared for a variety

of contingencies. The attacking force determines the time and the part of the line where the brunt of the action is to fall, and the larger the forces engaged and the longer the line the more difficult it will be for the defensive to bring their reserves to the proper place at the right time.

The difference in the tactics employed in the various types of engagements have a corresponding influence upon the dispositions of sanitary troops, as the character of their service is so dependent upon, and so intimately connected with the movements and operations of fighting troops.

In a rencounter the uncertain situation makes it impracticable to make any but the most general preparations for the rescue and care of the wounded, and definite steps toward establishing stations and lines of evacuation cannot be taken until the engagement has progressed to the extent that the further course or final outcome becomes apparent. It is inadvisable to even attempt, at the beginning, to indicate locations of dressing stations or field hospitals as long as it cannot be foreseen whether the position can be maintained and where the severe action will develop. The divisional sanitary units are to be kept in hand at a safe and convenient place until clear indications arise for their use.

In a planned attack, however, the situation is much clearer, and from the formation of troops and the orders given it may be determined where and when the greatest need for surgical assistance will probably arise, and arrangements may be made accordingly. It may not often be advisable to make complete detailed arrangements for the establishment of stations and evacuation routes as it is not possible to predict with certainty the manner the action will develop, and it follows that the preparations for battle should not be strictly limited to a single course of events. This is especially true of the medical department, which, from its relative lack of mobility is more easily enveloped or overwhelmed. Sanitary units, however, can be placed so as to be within convenient reach of prospective locations, and in readiness to establish as soon as the necessity therefore arises.

The extra transportation can also be assembled at suitable places and a location for the station for slightly wounded fixed upon.

The arrangements made for a division making a frontal attack must also differ from those made for one that has been assigned to make a flank movement.

It is quite evident that the relief service during an attack presents most difficult problems and the division surgeon must exercise much judgment and caution. The continual advance of the line, the sudden variations in the military situation, and the necessity of maintaining constant touch therewith, all complicate the sanitary service.

In planned defensive actions the situation is much simpler. The ground being well known, sites for stations can be selected and prepared and the sanitary organizations can be so placed as to be ready for immediate service when the emergency arises.

Practical experience in war has often demonstrated the fact that a successful medical service in war does not so much depend upon the excellence of the surgical service as upon the efficiency of the medical department administration.

It must also be emphasized that if a large number of wounded are to be taken in and cared for in a very short period of time, *the transportation of the institution to the patients, rather than the patients to the institution,* is a sound principle to follow whenever circumstances permit.

There is some diversity of opinion among experienced medical officers as to the number and variety of stations that should be established on the battle-field for the collection and care of the wounded, but the consensus of opinion seems to be in favor of as few, within limits, as possible. It is true that the more the sanitary personnel of a division is broken up into small detachments, the less will be the sum of work that they will be able to accomplish, but it would be foolish to ignore the experience of years and break away entirely from the methods evolved by our predecessors from practical experience, and make radical changes based upon theoretical considerations alone. The idea, however, that a fixed succession of stations should be

ded out, must be emphatically combated, as it might en that a combination of at least two stations would ded advantage.

tion to the influence that the type of engagement and ter of the terrain have upon the disposition of the nits, the transportation facilities for the removal of must be taken into consideration in formulating a ction. The proximity of available rail or water- ld facilitate the execution of this most important connected with the battle service, and instead of for the care and shelter of all the more severely at or near the field, steps could be taken at the very of the battle to provide for the evacuation of patients as they fall into the hands of the medical department. den of the field hospital at least would be much lightened ir capacity could be largely reserved for the the non- table cases. The line of communication authorities lso be expected to take the latter mentioned class over much delay and thus again free the institutions for emergencies.

medical department of a division is presumably complete and sufficient to meet the needs of the command in battle. prises, as noted in Chapter III, the regimental medical and detachments of the hospital corps, four ambulance ies, four field hospitals, the administrative staff, and the supplies carried in the supply train.

organization is primarily provided for the service in the active operations, and its most important function from ry standpoint is to supervise sanitation and to rid the its non-effectives. It establishes the following stations battle-field and the evacuation routes leading therefrom I):

1. Regimental aid stations.
2. Dressing stations.
3. Field hospitals.
4. *Station for* slightly wounded.

With the exception, perhaps, of the aid stations, they are established by direction of the division surgeon and supervised by the directors of field hospitals and ambulance companies.

Regulations make no pretense of providing specific rules and directions for the use of the various sanitary organizations on the battle-field and only indicate a few broad general principles.

The most that can be accomplished in the following discussion of the time of establishment and the location of stations on the field is to indicate the various conditions and influences which must be taken into consideration in coming to a decision, and it must in each specific case be left to the judgment of authority familiar with the local conditions to formulate a plan that will fully meet the requirements.

The division surgeon remains at division headquarters where he may keep himself informed of the situation from the reports received and the orders issued, and thus be prepared to take timely steps to adapt his schemes for the rescue of the wounded to the variable phases of battle. Always keeping the main purpose of the army in mind, he must not permit any of his measures to interfere in any way with the movements of troops or ammunition or to occupy positions that may become of tactical importance or to use roads that should be kept open for the ammunition supply service.

It is reiterated that the success of the relief service depends very much upon the rapidity with which the wounded can be evacuated to the rear. The division surgeon must, therefore, make all his arrangements and dispositions to attain that object.

CHAPTER VI.

REGIMENTAL SERVICE AND AID STATIONS.

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The sanitary personnel allowed to an infantry or cavalry regiment in active service comprises a major, three captains and lieutenants, a sergeant first-class, three sergeants, and 20 privates of the hospital corps. (Among these privates, the four medical officers' orderlies are included.) Artillery regiments which are two battalion organizations are allowed only three medical officers, three non-commissioned officers, and 18 privates. This detachment is directly under the orders of the regimental commander, who, in theory at least, directs all their movements on the march and in battle. The technical duties of the regimental detachment are, however, performed under the general direction of the division surgeon, who must co-ordinate and systematize the service of the entire medical department of the division, as otherwise it would not be possible to attain that concerted action which is so essential to success.

It is utterly impracticable for the division surgeon to direct the details of the regimental sanitary service and he can only indicate the general plan that has been determined upon for the relief of the wounded of the division, and the regimental surgeon must work out the details of the service within his sphere so as to fit in with the general scheme.

In practice, the senior medical officer, as a staff officer of the regimental commander, is held responsible for the proper care of the wounded at the front and supervises and directs the work of the detachment.

During the development of an engagement, the senior medical officer must remain in constant touch with the regimental headquarters and keep himself informed of the military situation

in so far as the regiment is concerned, so that he may adapt his scheme for the relief of the wounded thereto. He should consult with the commander as to the time and plan of establishing a provisional or definite aid station and as to the disposal of wounded should it become necessary to leave them behind.

If communication with division headquarters is to be had, reports of the establishment and breaking up of stations would be sent to the division surgeon or the director of ambulance companies; also the number and character of the cases on hand and the location and number of wounded left behind or sent to the rear.

The location of stations or groups of wounded may often be conveniently indicated by simple sketches on report blanks (page 27). Such reports are of special importance when collections of wounded have to be abandoned in order to maintain contact with the regiment.

On the march the surgeon rides with the regimental staff and the junior medical officers in rear of their respective battalions. The detachment of the hospital corps, orderlies excepted, is with battalions or in rear of the regiment leading the pack mule.

In battle, the senior medical officer with one assistant, the sergeant first-class, and several privates, take station at the regimental aid station, and the remaining members of the hospital corps under the supervision of the medical officers endeavor to give assistance to the wounded on or near the firing line and direct or transport wounded to the designated place. The members of the regimental band are also supposed to be avaliable for bearer service during and after battles. Ordinarily not more than six litter squads can be turned out from the regimental detachment—two squads under a non-commissioned officer for each battalion. The remaining enlisted men serve at the aid station and as orderlies.

The regulation regimental medical supplies for the regimental dispensary and for the aid stations are carried on the supply wagon and by the pack mule, the wagon ordinarily accompanying the field train. The pack mule is provided for the

special purpose of transporting supplies needed in battle, as it may often be impracticable to follow along with a heavy field wagon which will probably only be on hand at the conclusion of the engagement or after nightfall, when the aid station is established on or near the field of losses. While only a very limited supply can be carried on one animal, it is presumed that it may often be possible to send the mule back to the supply wagon or to the reserve supply train for additional material.

The regimental supplies include, in addition to various utensils and appliances, first-aid packages, antiseptic gauze, absorbent cotton, bandages, wire and wood splints, antiseptics, etc.

The regimental aid service has become of much greater importance under modern conditions of warfare, not only because it is now more difficult to approach the line of battle from far in rear, owing to the increased range of weapons, but also in view of the greater good that can be accomplished by modern surgical methods of preventing infection by prompt protective dressings, which ultimately results in saving a large proportion of the trained men for further duty at the front. The experience in the Russo-Japanese War has conclusively demonstrated the efficiency of proper first-aid dressings, and it is stated upon good authority that the ultimate results were better in those cases in which it had been applied by medical officers.

It must be admitted that, unless the terrain is particularly favorable, but little real surgical work can be done at or near the firing line, but it is quite generally accepted that the presence of sanitary personnel at the front gives an assurance of speedy professional assistance that has a powerful effect in sustaining the morale of troops and relieves them of the temptation to accompany wounded comrades to the rear. The history of our own wars indicate that the absence of such assurance has often had a depressing influence upon the morale of troops.

The benefits to be derived from prompt and proper wound treatment, both from a military and a surgical standpoint, are now considered to be of sufficient importance to warrant the sacrifice of *some* sanitary personnel and casualties are bound

to occur among them if they perform the full duty now demanded of sanitary soldiers.

It is neither desirable nor practicable to give extensive surgical treatment to the wounded at or near the firing line, and the primary function of the regimental sanitary detachment is to assemble and prepare them for further transportation to the rear. The assistance given in front of the aid station is limited to the application of dressings contained in first aid packages and the material carried in hospital corps and orderly pouches. At the aid station such dressings may be readjusted or replaced if soaked through with blood, or supplemented by additional material. Compresses are applied to bleeding wounds and occasionally it might become necessary to ligate an artery or perform some other emergency operation, as tracheotomy, etc. Fractures are immobilized with splints. Restoratives and narcotics must be given, and morphine in convenient form for hypodermic use is an essential remedy. Cases attended with symptoms of shock will be given the usual treatment. Stimulating food and drinks must also be prepared.

It is presumed that no surgical operation except those of extreme urgency will be performed at the aid station, unless the regiment is acting independently or is cut off from communication with the dressing station or field hospital for a long period of time by accidents of terrain or other causes.

The difficulties of applying ordinary antiseptic measures in the treatment of wounds at the front can in a measure be met by adopting methods that found much favor in the Manchurian campaign. The use of an iodine solution to sterilize the skin about wounds has been highly recommended, and if bichloride gauze in small packages is furnished it makes it comparatively easy to assure reasonable antisepsis. v. Oetlingen suggests the use of a solution of mastic in chloroform which leaves an impermeable layer of gum on the skin and prevents the bacteria from spreading into the wound openings.

The regimental supplies include all that is required for ordinary *emergency* surgery and the life or limbs of patients should

not unnecessarily be jeopardized for want of proper attention. It would hardly be justifiable to leave the severely wounded subjected to the danger of infection if it was at all possible to apply an occlusive antiseptic dressing. A simple first-aid dressing safeguards a severe wound only for a limited time, especially during hot weather or in the tropics. It is, however, to be strongly insisted upon that all needless or unnecessary handling of wounds is dangerous and no manipulation thereof should be attempted except under proper antiseptic precautions. It does not necessarily follow that the aid station is always crowded with wounded, and the surgeons should not sit with folded hands if it is at all possible to apply permanent dressings. Not only are the interests of the wounded directly conserved thereby, but the dressing stations and field hospitals would also be relieved of some of their burden.

In severe battles when the number of casualties in a regiment may run into the hundreds, it is obvious that the surgical service at the aid station must be limited to application of first aid dressings, the readjustment of dressings already applied, controlling hemorrhages, fixing fractures and the administration of restoratives and narcotics, and only the simplest methods would be used.

It is not expected that any elaborate arrangements for the care and treatment of wounds can be made at an aid station, and it may often become but little more than a place for assembling wounded. The necessity of maintaining constant contact with the regiment may demand a sudden abandonment of the station, and if too permanent arrangements are made the mobility of the institution might be seriously compromised. It is only after the lines have come to a standstill, a successful conclusion of an action, or at nightfall that the more definite establishment can be made. It is, however, usually worth while to improvise dressing or operating-tables from litters and to arrange the supplies, without entirely unpacking, so that they will be easily accessible. A water supply is always essential to the comfort of the wounded and some will also be needed for

the preparation of restoratives and for antiseptic solutions. Shelter is desirable, especially in inclement weather, but some caution must be exercised in selecting buildings for the purpose as they are apt to become targets for the enemy's artillery. Shelter may be improvised from tent flies and shelter halves. An effort should also be made to procure hay and straw for the severely wounded to lie upon. The regimental supplies also include some hospital stores, and a fire should be built, if conditions permit, for their preparation.

Under ordinary circumstances wounded are not carried farther back than the aid station by the regimental detachment, and it is necessary for the ambulance company to take them over at that point. The station should not be allowed to become overcrowded and every opportunity should be taken to send such as are able to walk to the rear.

The classification of wounded into the various categories must begin here; the slightly wounded are to be assembled in groups and directed to the station for slightly wounded; the more severely wounded that are able to go some distance are sent to the dressing station or field hospital, and those requiring transportation are to be dressed and made comfortable until the litter bearers and ambulances can remove them. The "non-transportable wounded," abdominal injuries, severe wounds accompanied by much shock, etc., are given proper attention until they can be carefully moved on litters to the nearest field hospital.

While the sanitary detachment of the regiment must be prepared at all times to give first aid to the wounded, it does not imply that it is by any means necessary that a formal aid station is to be established at the beginning of an engagement or as soon as some casualties have occurred. It is very essential that the regimental sanitary personnel should not lose contact with their unit, and a hasty establishment while troops are moving forward would probably result in a separation. The first-aid packages carried by the soldiers and the contents of the hospital corps and orderly pouches would furnish sufficient dressing material for those wounded while troops are advancing into

battle. The wounded able to march would be directed to the station for slightly wounded or to a dressing station and those that were unable to proceed to the rear by their unaided efforts must be left in some protected place along the line of march to be picked up later by an ambulance company. Such wounded must be speedily attended and the sanitary personnel engaged in such work must rejoin as quickly as possible. It would be inadvisable to leave attendants with them, except under extraordinary circumstances, as they would in all probability be urgently needed after the action had fully developed.

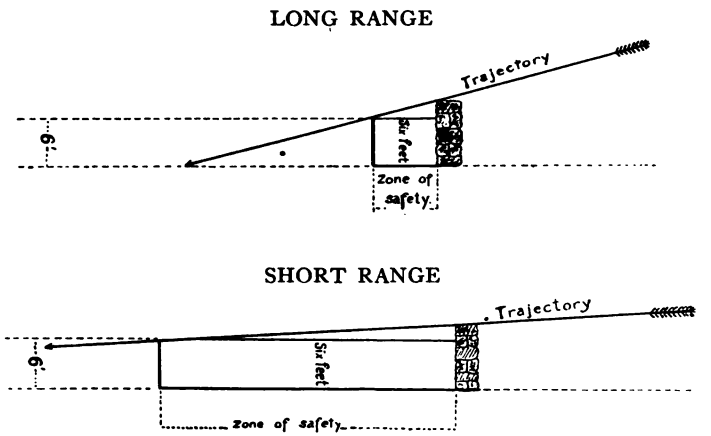

FIG. 9.

Protection from the enemy's fire is the first and most important consideration in the selection of a location for the regimental aid station, consequently the nature of the ground and the cover afforded thereby is the determining element. Should an engagement take place on level, open country, the question of establishing an aid station would not arise until after its conclusion or when darkness had set in. Fortunately, some good cover can usually be found, and owing to the flatness of the trajectory of the modern bullet, a moderate rise of ground, a

sunken road, a gully, or other natural feature of the ground may give the necessary protection, if the place is not too far away from the enemy's firing point (Fig. 9). If the trajectory, and especially the slope of fall of bullets is recalled, a study of a contour map would furnish a reliable guide in determining the places that may properly be considered.

Some recent writers have maintained that the location is largely determined by the wounded themselves, and that the latter naturally drift to the most convenient place and it only remains for the regimental surgeon to bring up his supplies and the location is then fixed. However, if the ground is looked over and the map carefully studied, it might well be seen where the natural route for the wounded making their way to the rear lies, and the station established with reference thereto.

As this station must necessarily be within the danger zone, it follows that it should be as near the firing line as good cover can be found, and of two equally safe places the one nearest the front should be chosen. Should the situation and terrain permit that some of the wounded at least could be collected during the progress of the engagement, the work of the bearers would certainly be much facilitated, and the mere possibility of retreat should not deter the establishment near the line, as the wounded would be at least as well off at the aid station as lying on the field. The beneficent provisions of the Geneva Convention would certainly give them the same protection there, and in addition thereto, if disaster occurred and a number of wounded were left behind at the station, some sanitary personnel could be left with them to assure them of the necessary care and attention.

In addition to cover, it is desirable that the place should afford some convenience, such as shelter, water, and fire-wood, which are quite necessary for the comfort of the wounded. It would also be advantageous if it was located at a point affording convenient access to the front and to dressing stations and field hospitals in the rear and that at the conclusion of the action, ambulances could approach and remove the severely wounded, thereby saving much time and labor of the bearers.

In addition to the influence that the character of the ground has upon the selection of an aid station, the type of the engagement and the tactics employed have an important bearing upon the scheme to be adopted for the rescue of the wounded.

In a planned attack the difficulties encountered in the effort to give prompt assistance to the wounded are much greater under modern conditions as a consequence of the style of tactics that are now being employed. The greater range of firearms has increased the extent of the zone that has to be covered under fire and the duration of battles has increased in like proportion. The attacking line may often be held in check for hours until sufficient impression has been made on the enemy to permit of further advance. The regimental sanitary detachment must maintain effective contact with their units as the line may be cut off from all communication with the rear for hours, and the wounded cannot, for reasons already given, be allowed to remain unattended for many hours.

The closer the assailant gets to the enemy, the greater the probable number of casualties, and after he arrives near enough to prepare for the decisive action, it would hardly be possible, except under especially favorable conditions of terrain, to cross the entire danger zone to bring prompt aid to the wounded. If it is true that about 30 per cent. of all bullets fired in severe engagements fall within a space extending from 1000 to 2000 yards from the firing point (Wolozkoi's estimate), an aid station beyond this zone might be absolutely cut off. In their efforts to remain in contact with their units, the sanitary personnel is not necessarily exposed to the same extent as the troops of the line. The small detachments can take advantage of the best route that the particular terrain affords and of the lulls in the firing. Should it become necessary to cross exposed ground, they must advance by rushes just as other troops do.

While a definite establishment of a regimental aid station early in an attack would probably be a great mistake, it is necessary that provision should be made for those wounded in the earlier stages of the action and a series of temporary stations

may have to be established where wounded may be collected and given surgical aid. Such as are able to march would be sent to the rear if practicable, and the remainder left to be picked up later by the ambulance companies.

A formal regimental aid station cannot be established until the advance ceases, the engagement terminates, or night sets in, and then the nearer it is to the field of losses the more rapidly and effectively the wounded will be collected and treated. If it is possible to approach to within a decisive range (600 or 700 yards) of the enemy's position under fair cover, it would probably not be necessary to establish until that point is reached, but this would rarely be possible, and usually the line will come to a temporary halt a number of times before the decisive point is reached, and the number of wounded on hand will compel the establishment of a station.

In a defensive action the conditions are much simpler than in an attack. The ground may be thoroughly reconnoitered and tentative locations may be selected for all the stations and evacuation routes, and the personnel and supplies placed in readiness at or near the proposed locations to establish as soon as the necessity arises.

The use of the field howitzer has made this service more dangerous and the possibility of being reached by high-angle fire must be kept in mind in judging of the efficacy of cover.

The aid station in defense must also be at or near the firing line if a rapid and efficient service is to be carried on. Behind strongly fortified positions the best location would probably be on the line itself where bombproofs, etc., may afford good cover. Some caution must, however, be exercised in fixing upon the place for a definite aid station, as it by no means follows that in a defensive action the position of the line may not be changed during the course of the action and a movement thereof may be necessary to follow the tactical movements of the enemy.

The regimental surgeons of the regiments held in reserve have no means of determining where the organization may be called upon to go into action, but as they are presumably familiar

with the terrain, no special difficulty will be encountered in finding the proper place when the time arrives.

The division surgeon's general plan for the care of the wounded will be known and the aid stations may often be arranged so as to facilitate communication with the dressing stations and field hospital during action.

It would be difficult or even impossible to lay down anything like a definite plan of action for the regimental sanitary detachment in a rencounter. The uncertainty as to the tactical situation and probably a lack of accurate knowledge of the terrain complicate this service very much, and it is not until the action has developed and the further course or ultimate outcome become clear that any definite and systematic steps can be taken for the rescue and care of the wounded. It behooves the regimental surgeon to act with great caution, and special efforts must be made to maintain close contact with their respective units. After the action has developed sufficiently, they may proceed to carry on the service in a manner as suggested in the discussion concerning the aid service in attack or defense as may be called for by the situation.

The greater accuracy of modern artillery fire and the massing of a large number of guns at artillery positions have brought about a change in the idea that formerly obtained concerning the location of artillery aid stations, and it is now quite generally accepted that they may be placed nearer the batteries than was formerly considered practicable. The danger zone from overshots in rear of batteries is not as deep as that from infantry fire and it is now considered to be advisable to endeavor to locate the station close thereto, and by preference near the inner flank which is less exposed in case the enemy attempts to envelop the position. To put it with the ammunition reserve would ordinarily be dangerous, as the enemy would endeavor to interfere with the ammunition supply whenever possible, and a station at this point might easily come within the range of exploding shell.

The aid service with *cavalry in attack* presents its peculiar

difficulties and it can hardly be compared to that with infantry or artillery. The greater mobility of cavalry troops and the extent of ground that may be covered rarely permit the establishment of formal aid stations and the wounded are given such attention as circumstances may permit. Fortunately, the proportion of wounded is usually much smaller than with other arms of the service, and a very large percentage of those may be brought to a proper place in the rear on their mounts and no such extensive provision will have to be made for their care near the front. Severely wounded may have to be left in sheltered places along the route in the hope that they may be picked up by an ambulance company.

When large bodies of cavalry are employed in attack, the sanitary personnel must be held back, as no good purpose can be accomplished by accompanying a mounted command into action, and an extensive aid service cannot be initiated until the conclusion of a successful engagement, when stations may be established at the most convenient places on the field of losses. *After defeat*, the question of sending out sanitary personnel under the protection of the Red Cross flag may arise. There is no doubt that the wounded would receive more satisfactory care from their own comrades than at the hands of the enemy, as the latter will probably be fully occupied with his own.

But little can be laid down regarding the aid service with smaller bodies of cavalry in skirmishes incidental to the service of security and information. No extensive aid can be rendered, as the surgical supplies will probably be limited to those carried by the individuals of the sanitary detachment. The details of such service must be worked out at the time and place. First-aid dressings must be applied and every effort made to transport the wounded to the rear.

Owing to the relatively small number of sanitary troops allowed a regiment and the large proportion of casualties that may be expected in any severe engagement, it is very important that the labor of rendering first aid and collecting the wounded *should begin as early as possible.* The amount of labor involved

will be so great that the authorized medical department personnel can hardly hope to be able to clear the field within a reasonable time without help from other sources.

It must not be forgotten that if the enemy is driven off the field, many of his severely wounded will also have to be cared for, although it is presumed that when regular aid and dressing stations are captured, the medical officers on duty there will continue their work and would not be allowed to depart until it had been completed.

After a successful engagement, the field would have to be thoroughly gone over by the sanitary detachment, assisted perhaps by detachments from the regiment, to discover and bring in severely wounded that may have hidden away during the action. The search of the field may often have to be carried on after nightfall and lanterns or other means of illumination will have to be used, but unless the enemy has withdrawn, lights may draw his fire, a circumstance which occasionally happened in the war in Manchuria.

No time must be lost, as the sanitary detachment may have to follow its regiment in case a pursuit is inaugurated or if a renewal of the engagement is in immediate prospect. As indicated above, the ground may be of such a nature as to preclude any systematic rescue of wounded during the progress of the action, and should the enemy be defeated and withdraw, the aid station would be established at the most convenient place on the field of greatest losses, where the wounded can be easily assembled for evacuation by the ambulance companies. In a short, sharp engagement with many casualties, the same course is indicated.

A sudden retreat would demand a hurried breaking up of the station, all wounded able to march would be directed to some designated place in rear and the severe cases for which there was no transportation would have to be left behind with the necessary attendants and supplies.

After the field has been cleared and all the wounded turned over to the ambulance companies, the regimental surgeon must at once take the necessary steps to renew the supplies from the

reserve supply train and prepare to resume his place with his regiment.

In addition to the wounded, an unusually large daily increment of sick may be expected, which will have to be treated and provided for before the labors of the day are concluded.

Casualty returns and complete reports of the service performed will have to be submitted as soon as practicable.

CHAPTER VII.

DRESSING STATIONS

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Dressing stations are established, upon the order of the division surgeon or director of ambulance companies, by the ambulance companies, which, in addition thereto, are charged with the duty of transporting wounded from the regimental aid stations and, when practicable, from the field, to the dressing stations and field hospitals by means of litters, ambulances, travois, and improvised transportation.

As noted in the chapter on Organization, the ambulance company comprises five officers, two sergeants first-class, seven sergeants, and seventy privates. The transportation belonging thereto includes twelve ambulances, three field wagons, four pack mules, and four travois. Regulations only fix the personnel assigned to conduct the transportation, one officer, two non-commissioned officers, and twenty privates, including fifteen drivers, the horseshoer, saddler, cook, and two musicians. The remaining officers, non-commissioned officers, and men constitute the dressing-station party and the litter bearers. It is presumed that three detachments of about five litter squads each under a non-commissioned officer are available as litter bearers. It is not, however, considered practicable to definitely assign each and every man to some particular duty, as that can best be done at the time and place by the commanding officer.

It cannot be expected that the limited force of the ambulance companies will be able to fully meet the emergencies of a severe battle attended with many casualties, and the chief surgeon most be prepared to augment it by details from sanitary detachments of organizations not actively participating, and possibly from field hospitals that are awaiting establishment.

Regulations provide that one medical officer may be detached from each regiment for service at the dressing stations or field hospitals. In long drawn-out battles additional help may have to be brought up from the line of communications for temporary duty until the evacuation service is well under way.

It will be noted that a formal ambulance station has been done away with in the new organization in the interests of simplicity, although it by no means implies that ambulances will not be expected to work as far to the front as the enemy's fire will permit.

The maximum capacity per trip of the ambulance company transportation, when working in connection with an established dressing station and using the twelve ambulances, sixteen litter squads, and four travois, would not exceed sixty-eight recumbent patients. Should the ambulances be loaded with wounded able to sit up, the number would be increased to 128, including twenty recumbent cases on litters and the travois.

The dressing stations constitute the second line of assistance, and serve as points of assembly for wounded, and afford much better facilities for the surgical treatment of the wounded than the aid stations. They are also the first places in rear of the line where a regular classification of patients, so necessary to a systematic service, can be properly carried out. A firm and rigorous policy must be adopted when large numbers are being received so that the transportation will only be used for those who absolutely require it. Patients who are able to walk to the advance base must be directed to the station for slightly wounded, not to the field hospitals, as the latter may not suffice for the severe cases.

The omission of the dressing station and the assignment of personnel to the regimental service has been advocated on purely theoretical grounds, but recent experience in Manchuria seems to indicate that, owing to the depth of the danger zone, this station is even more necessary than formerly. Its omission might possibly be considered in a campaign carried on in a region that is covered by a network of available railways and

with greater transportation facilities than it has ever been possible to get in any of the wars of the past. Patients could then be speedily transferred from the aid stations to hospital trains for transportation to semi-permanent or permanent hospitals on the line of communications or the home country.

Many attempts have been made to definitely formulate rules for the surgical service at dressing stations, but the fact remains that the character and extent of the professional attention to be given depends very largely upon the number of cases that require treatment at the time and place.

After severe engagements, attended by numerous casualties, the interests of the individual will have to be sacrificed to some extent to the necessity of giving all the wounded some attention on the battle-field. Should the situation permit and the force at work be sufficient, every wounded man should receive a permanent occlusive antiseptic dressing, all hemorrhage checked, fractures cleaned and immobilized, and, in addition thereto, cases requiring urgent operations, such as ligation of bleeding vessels, tracheotomy, etc., etc., must be attended to in the operating department.

Operations are now less frequently called for than formerly, owing to the character of the wounds produced by modern projectiles and the use of antiseptic methods of wound treatment.

Many classes of wounds that in pre-antiseptic days required immediate active surgical interference to save life or limb can now safely be held over until the patients can be given the benefit of all the conveniences that a hospital affords, without incurring any special risk.

A record such as made in 1862 at Fredericksburg, for instance, which shows that 11 per cent. of all the wounded were almost immediately operated upon, will never be duplicated in modern times, and the operations at the dressing stations will be strictly limited to emergency surgery, and it is believed that less than 1 per cent. of the wounded would need such attention.

No arguments need be advanced to show the advantages that are to be derived from permanent antiseptic dressings and no

efforts should be spared to accomplish this result. Not only does it give protection against secondary infection, but patients so treated can be more easily transported and thus facilitate the most difficult problem that confronts the sanitary department in the field.

Our organization provides four complete and distinct dressing-station parties to cover the line of battle of a division, which normally extends from 3000 to 5000 yards, depending upon the character of the ground and whether troops are employed in attack or defense, it being customary to allow about three men to the yard in defense and five in attack; that is to say, about that number are necessary to give a reasonable assurance that one man per yard may be put on the firing line for the decisive conflict. This estimate of the number of men required includes supports and reserves.

Peculiarities of terrain and unexpected movements of the line may leave the dressing stations inaccessible from parts thereof, but an organization such as ours obviates some of the difficulties of breaking up and moving a station and permits of greater elasticity of the system of relief, and the division surgeon may exercise discretion in ordering the establishment of the companies.

It is usually considered inadvisable to maintain a special reserve of sanitary organizations, and it is held that all should be put in service as soon as any occasion therefore arises.

The number of separate stations that are to be established for the division line depends very much upon the terrain. The consensus of opinion seems to be in favor of combining dressing-station parties, or even uniting aid and dressing stations whenever feasible, as greater and better results may be expected from a concentration of forces.

The organization and internal administration of dressing stations is sufficiently set forth in the Manual of the Medical Department. All the transportation of the company is considered available for bringing up the necessary supplies required *at the station.*

In mountainous or other difficult terrain, the means of transport for battle supplies may be limited to the four pack mules. While the amount carried by the four animals would prove inadequate for even a moderate number of casualties, it is to be presumed that the transportation would be sent back to the wagons or the reserve supply train for the additional material needed.

The place to be selected for the station should be large enough to admit of an orderly arrangement of the different departments, otherwise confusion would result that would seriously interfere with a systematic and rapid service.

Some shelter is necessary, not only for the dressing and operating departments, but also for the wounded awaiting attention, and for those who have received treatment and are awaiting transportation to the rear.

The tentage ordinarily carried by the ambulance company would not be more than sufficient for the first-named purpose, and, unless buildings were at hand, efforts must be made to improvise shelter against the elements by the use of shelter halves, blankets, etc.

Some time may elapse before field hospitals can be established and the transport service set in motion, and in inclement weather some such provision is quite essential.

Water and fuel must be procured and a kitchen established so that stimulating foods can be prepared and water sterilized for surgical purposes.

The dressing station and the roads leading thereto must be conspicuously marked so that they may be seen at some distance. Red Cross flags and green lanterns are used for the purpose.

It is essential that the place selected should be well protected from the enemy's fire and advantage must be taken of irregularities of ground and the cover afforded by substantial buildings, etc. A comprehensive knowledge of the range, trajectory, and penetration of projectiles is necessary to properly estimate the qualifications of a proposed site. The chief surgeon and the director of ambulance companies must also have a practical

knowledge of map reading in case it is impracticable to reconnoiter the ground.

The question of convenience of access from front and rear is also of great moment, and if possible the station should be placed on or near a well-marked and well-known route leading to the rear. At the same time it must not be so placed as to occasion any obstruction to troops moving to the front or to the ammunition supply service, nor should a place be selected that is likely to become of tactical importance. It would, however, be unwise to establish in a deep ravine or gully, which, although it may afford ample protection against fire, would be so difficult of approach as to make the transportation of wounded to and from the station almost impracticable.

It must not be thought that the selection of a site and the establishment of a dressing-station is always an easy problem. In a series of rapid and decisive conflicts attended with heavy casualties the capability of the medical department will be strained to the utmost limit. Even under the most favorable conditions of terrain, improper locations may entail many additional difficulties, both in the transportation of patients and in their care and treatment.

Inclement weather, heavy roads, etc., all conspire to make the work one of great difficulty and the ambulance companies may have to labor night and day, with only short intervals of rest, and if, in addition thereto, badly located dressing stations complicate the situation, the medical department may easily be overwhelmed.

Greater caution must be exercised in the establishment of the dressing station than in the case of aid stations on account of the relative lack of mobility of the former. After the stream of wounded is once directed to a certain location some time is required before it can be diverted to another place, nor can the supplies all be packed until all the wounded that may have arrived have been attended and prepared for transportation to the rear.

It would be unwise to omit the establishment of this station on account of a mere possibility of retreat. On the other

hand, it would probably be a mistake to attempt a definite establishment behind a position that could not be held if vigorously assaulted; not so much on account of the liability of the wounded falling into the hands of the enemy, but of the probability of their becoming exposed to his fire in the pursuit.

The same general principles mentioned in the discussion concerning the location of aid stations apply to the selection of the site for the dressing station, but better cover and more space is necessary, as the number of cases to be treated there will be very much larger than at any one of the aid stations.

It was formerly customary to also indicate the proper location of the dressing station by directing that it should be put a certain number of yards in the rear of the line of battle or of the reserves, the point being always well beyond the range of the firearms then in use. Under modern conditions an effort would be made to establish somewhere within the danger zone from overshots, if proper cover can be found therein.

To put the dressing station far away from the line of aid stations would not only enormously increase the labor of the bearers, but would also defeat the object of speedily assembling the wounded and giving them the better surgical care afforded by the station. Some authorities contend that the dressing station should not be much farther away from the line than the regimental stations, and that much would be gained if it was near enough to combine with it one or more of the aid stations.

From all that has been said it may be concluded that the dressing station should be as near the line as the character of the cover afforded by the terrain would permit, and of two equally well protected and otherwise convenient places, the one nearer the front should be chosen. Always with the proviso, however, that the special tactical situation, as observed by the division surgeon or communicated to him by the commander will permit of its being done with reasonable safety. It must not be so close as to render it liable to be involved in ordinary fluctuations of the line of battle.

Much would be gained if the location was easily accessible and afforded good cover from enemy's fire. It is quite plain that the further the dressing station is to the rear the greater would be the probability of interference with the work of the bearers by fire-swept zones.

It has been seriously proposed that a provision should be incorporated in regulations directing that dressing stations should not be established until after the decisive combat had taken place. Such a course might easily be followed in a short engagement lasting only a few hours. It has been shown, however, that modern combats are likely to extend over a period of several days, and as lulls and pauses occur from time to time the wounded will make their way to the rear and the necessity for the dressing station at once arises. Even during the active combat wounded will avail themselves of covered ways to proceed to the rear, and if the straggling of wounded over the field is to be prevented, provision must be made for assembling them, and the ambulance companies must be prepared to collect them and give them the needful attention.

The type of the engagement and the kind of tactics must be taken into account in formulating a plan for the use of the sanitary companies and the establishment of dressing stations.

Great difficulties may arise in connection with this service in an **attack.** The lack of accurate knowledge of the terrain, the constant tendency of the line to advance, and the varying phases of the tactical situation give rise to much uncertainty.

Much ground may have to be traversed under fire before the advancing line comes within effective range of the enemy and the ambulance companies may have much difficulty in keeping within reach of the troops which they are expected to serve. They must push as far to the front as the enemy's fire and the tactical situation permits, but not so close as to run the risk of being involved in the fluctuations of the line of battle. The terrain may often offer sufficient cover so that the ambulance companies may come up to within a reasonable distance and *there await a proper* opportunity to establish.

The urgent necessity for dressing stations will probably not arise until the troops have arrived within effective range, and then the zone of overshots will be so well covered by flying projectiles that an advance over exposed ground will be utterly impracticable and the companies may have to wait for a lull or until the tide of battle temporarily shifts to some other parts of the field. The time lost under such conditions can easily be made up if the stations can finally be put near the aid stations and the field of losses.

When many casualties have occurred, dressing stations must be established if it is at all practicable. The division surgeon must not act with too great caution for fear of retreat or unexpected movements, nor should he allow himself to be misled by the experience obtained at maneuvers where tactical procedures are often carried out in a few minutes that might require hours for their accomplishment in actual engagements.

It is, however, considered to be a great mistake to establish early in an attack, as the station would soon be left so far in rear as to preclude an effective service. It is also said to be inadvisable to fix the site of dressing stations in battle orders, but with four dressing-station parties per division it might be of advantage to fix the location of one of them in the orders that insure the greatest publicity, to serve as the objective for the wounded able to walk. Some of these will endeavor to make their way out of the danger zone, and a conspicuously located dressing station would do much to prevent promiscuous straggling of wounded. As soon as the other companies have definitely established near the field of losses, most of the personnel of the first station may be withdrawn to reinforce them.

The selection of definite locations during the progress of the engagement requires a keen insight into the military situation on the part of the division surgeon. He must keep himself thoroughly informed of all the tactical movements of troops and use his ambulance companies accordingly.

The largest number of casualties are to be expected on that part of the field where the attempt is to be made to break the

enemy's line, and special provision must be made there for large numbers of wounded. Ordinarily it would seem advisable to await definite establishment of dressing stations until the line had come to a standstill and the number of casualties justified it.

It may happen, as it often occurred in Manchuria, that no definite steps could be taken to establish near the line until late in the day or after nightfall, but if they are then put at the aid stations or on the field of losses, the wounded can be assembled there without loss of time in transportation and given the necessary attention.

Stations should not be placed on the exposed flanks, for while such stations may be safe from frontal fire, they would be involved should the enemy make a flank attack.

As in the case of aid stations, the establishment of dressing stations in a **defensive engagement** presents less difficulty than in the attack, and a systematic service is more easily inaugurated. More orderly arrangements can be made in advance for the evacuation of the wounded, and the transport service on the line of communications is usually prepared to take over the wounded sooner and thus relieve the organizations at the front. The ground being well known, tentative locations of stations and evacuation routes can be selected in advance and definite instructions concerning many of the details of the service can be given by the division surgeon.

Sanitary units can be held in readiness near the places tentatively choosen as the sites of the stations, to establish as soon as the number of wounded justify it. Supplies can be brought up and distributed where most needed.

There is, however, some uncertainty about the situation that renders it advisable that the division surgeon should exercise some caution in giving final orders for the establishment of dressing stations, as it cannot be definitely foreseen where the enemy will make his strongest effort and when and where the brunt of the engagement will fall. A careful division surgeon will therefore await developments before he makes his definite arrangements. It is clear that the greatest casualties must be

expected at the point where the enemy attempts to break the line or on the flank where he endeavors to make an enveloping movement.

A reserve of sanitary troops must be maintained, only to be put into service when the reserves are thrown into action, when the enemy makes his decisive attack.

The stations must not be too near the line where the decisive action is fought, as the enemy will concentrate his artillery fire thereon, and it would be difficult to find good cover, especially if howitzers were being used. Furthermore, it must not be so near as to become easily involved in slight fluctuations of the defensive line.

Nothing definite can be laid down concerning the establishment of dressing stations in a **reencounter,** the situation being much more uncertain than in the other types of engagements, it behooves the chief surgeon to await developments before taking any active steps to establish dressing stations. Usually the divisional sanitary units are so far in rear that the situation will have cleared before the ambulance companies can be brought within reach. They are then used as in attack or defense, according to the tactics employed by the troops they are serving.

The final arrangements for the care of the wounded on the battle-field will have to be more elaborate, as it cannot be expected that the evacuation service could be initiated as speedily as in connection with a planned battle. Field hospitals that have been marching with the trains will arrive late and wounded will have to be sheltered and cared for at the dressing stations for hours.

Ambulance companies serving with cavalry commands have an entirely different problem, unless with cavalry fighting on foot, when the same principles apply as in infantry. A regular establishment of a dressing station would be required only after a victory and the enemy driven off the field, when it must be put at the most convenient place on the field of losses.

In case of retreat the wounded that cannot be carried away from the dressing station are left with sufficient personnel and supplies. The transportation is hurried to the rear and carries

away the supplies and as many wounded as possible. The transportation and extra supplies must not be allowed to fall into the enemy's hands. Humanity demands that sufficient personnel and material be left for the care and comfort of the wounded. Not only such as may be absolutely essential, but everything that is necessary for their comfort should remain with them. War costs millions and the expense of a dressing-station outfit cuts no figure. The sanitary organizations of the troops that have been compelled to retire may soon be resupplied under modern conditions and the personnel will be allowed to rejoin their units in due time. The idea that the wounded who are left behind will be well cared for by the enemy and that actual and complete neutrality really exists among those engaged in each other's destruction is an idle dream of the humanitarian. At a time when both friend and enemy need help the comrade will first be looked after, and it would be too much to expect that the enemy's wounded would receive the prompt attention that their wounds require.

CHAPTER VIII.

FIELD HOSPITALS.

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FIELD HOSPITALS.

In our service only four field hospitals with a normal capacity for 108 patients each are allowed each division, although in foreign services the usually accepted standard is six hospitals of two hundred beds each. It is, therefore, of special importance that the greatest prudence should be exercised in their use as their capacity is so much below the requirements for the wounded of a division after an engagement attended with only a moderate percentage of losses. A cavalry division is allowed two, and an auxilliary division, one field hospital, with the same personnel and equipment as those of an infantry division.

When an engagement is at hand the division surgeon must always be prepared to greatly enlarge the capacity of these institutions as soon as they are established by drawing upon the extra supplies carried in the reserve supply train and upon local resources. The need of such preparation is apparent when it is considered that if a division sustains an ordinary 10 per cent. casualty, each field hospital may be expected to temporarily shelter and care for at least 300 wounded, to say nothing of an extra large daily increment of sick. The regulation field hospital organization comprising five medical officers, three sergeants first-class, six sergeants, forty-eight privates, and the necessary equipment, including 21 hospital tents, are carried on eight four-mule wagons.

It will be observed that our field hospitals are better equipped than those of most foreign services in that enough tentage is carried to comfortably shelter 108 patients in addition to that required for operating-room, dispensary, kitchen, etc., and, by using the tent flies belonging thereto, additional shelter may be improvised so as to increase the capacity to 162 beds. The

hospital is also provided with sufficient bed sacks for that number.

The practical result of this more elaborate equipment is that field hospitals must not necessarily be established in villages or towns. A large farm house with good barns would probably offer the required shelter even though the institution had to be very largely expanded. The choice of locations, is, therefore, not so limited and a great advantage may be derived therefrom, especially in sparsely settled regions, and the first transport problem may often be much simplified by the establishment of the hospitals at the most convenient places.

The indiscriminate use of these institutions for the care of the sick on the march or in camp, which immobilize them for the time being, might be followed by serious consequences in case of an unexpected engagement in that the already insufficient provision for the seriously wounded would be further reduced and the suffering of those that merit the greatest consideration would be needlessly increased.

It must be strongly insisted upon that these units are primarily for the use of the wounded, and to divert them, except in case of great emergency, to other purposes is liable to cause the most serious embarrassment. Emergencies may arise, however, that require them to be used temporarily for the shelter of the sick, but such use should be exceptional and only when the service of the line of communications is interrupted or inadequate or when there is no possibility of contact with the enemy. There is no objection to the use of the personnel of these hospitals when there is no immediate prospect of an engagement in connection with collecting stations for sick or in established hospitals in the vicinity.

In battle, field hospitals may also be used temporarily as dressing stations in case of emergency when the ambulance companies are fully engaged and a proper opportunity presents itself. Under such circumstances they need not be established as hospitals until the tactical situation permits of its being done with reasonable safety. The use of field hospitals for such purposes

might seem to be of great advantage to the wounded as it would spare them an additional move, but a general use of these organizations for the establishment of dressing stations cannot be relied upon as the trains of a division or field army must ordinarily be kept so far away from the zone of actual conflict that it is only under most exceptional circumstances, as for instance in a planned defense, that they could be brought on the ground early enough to render effective service as dressing stations. Field hospitals are too slow and unwieldly to be expected to maintain the close contact that ambulance companies are required to do in order to give speedy care and attention to the wounded. Opportunities may occur in planned battles when they may perform the dual function of dressing stations and field hospitals and receive patients directly from aid stations and from the field.

In severe engagements when the dressing stations are liable to be overwhelmed by the large number of wounded, some of the personnel of field hospitals that have not been established may be hurried to their assistance, to remain until their respective institutions are opened, when they must return with the first convey of wounded directed to them.

Field hospitals that are being held in readiness near the field may also serve a useful purpose by improvising a dressing station to render assistance to wounded who may have straggled to the rear and to assemble them until proper disposition can be made of them.

It is not intended that field hospitals should serve as permanent institutions for the care of wounded, and their stay therein must be short; only so long as it may be necessary for the chief surgeon of the line of communications to perfect his arrangements for taking them over and evacuating them to the rear or to convert them into evacuation hospitals. In the latter case an exchange of equipment is effected and the field-hospital organizations are released to again follow the division to which they properly belong.

Field hospitals are divisional units and when established simply constitute one of the stages *en route* from front to rear for the wounded of the division. If there is any probability of

another engagement, they must be speedily freed to meet the urgent necessity of giving the wounded shelter and that care which cannot be given at the aid and dressing stations.

Field hospitals constitute the first place near the field of battle where the more serious surgical operations may be performed with reasonable safety and where all wounds may receive permanent dressings. However, the facilities of these institutions are not to be compared with those of evacuation and base hospitals, and operative procedures that can be postponed until the patients can be transported to the latter-named institutions should not be attempted.

It is quite essential that field hospitals should be very mobile and their equipment must be as primitive as is consistent with the purpose for which they are provided. The necessary facilities and appliances for assuring reasonably good antiseptic surgery in an improvised operating-room, ordinary instruments and dressings are all furnished. Bed sacks, which are to be stuffed with hay or straw, are included, and it is presumed that when hospitals are established in towns additional bedding and appliances may be collected.

Every wounded man admitted must at least receive a permanent occlusive dressing, if such has not already been applied at the dressing station. Fractures must be cleaned and immobilized so that patients may safely stand transportation to a distance with minimum danger and discomfort. Patients with penetrating abdominal wounds will rarely require operation in field hospitals. Experience in recent wars has quite conclusively demonstrated that fully as large if not a larger percentage of such cases recover under expectant treatment. The facilities necessary for such operations are found in these hospitals for the exceptional case that may require them. Amputation of a crushed limb may occasionally have to be made and other emergency operations performed.

It must be recognized that the primary function of field hospitals is to afford speedy shelter and primitive hospital care for the wounded, and, as at aid and dressing stations, patients are

prepared for further transportation. The facilities for such work are much better than at the other stations and, what is more important, more time and care may be taken to accomplish the desired result.

Should it be impracticable to speedily evacuate these hospitals or turn them over to the line of communications, additional personnel would have to be drawn in from the division or from the service of the rear, and an opportunity would be afforded a large number of medical officers to do strictly professional duty. Such service is much desired by all earnest medical officers and every opportunity should be given them.

On the march, field hospitals habitually accompany the field trains, and whenever there is any probability of an engagement they are preceded only by the ammunition columns. When troops are marching into action, the trains are usually kept far in rear so as to be secure in case of reverse, and unless special dispositions are made, the field hospitals will be many hours' march away from the zone of conflict. It would not be advisable to bring these heavy organizations up close as long as the situation remained very uncertain, as they might easily be involved in fluctuations of the line, or at least they might prove an obstruction on roads used for troops and ammunition. The more mobile ambulance companies may have an opportunity to accomplish a great deal before it became practicable to bring field hospitals within reach.

It would by no means always be necessary to depend upon the tentage carried by field hospitals for shelter for the wounded, as buildings in a town or village would be preferable and the probability of good communication to front and rear would be much better than in the field. The shelter and the opportunity to collect additional beds, utensils, etc., afforded by a town would also be of value.

While a town will afford many conveniences for the establishment of hospitals, by the use of buildings for operating-rooms, wards, offices, etc., and the probability of finding a convenient water supply, fuel, and straw, there is always a possibility of a

conflagration which makes it advisable to avoid closely built up districts.

Access to a railroad or navigable stream would aid immensely in the subsequent evacuation of the hospitals. It would be a mistake to put them, except perhaps for wounded who cannot stand transportation, anywhere else than at a place that gave such facilities, if such a point was within convenient reach. Easy access from the front is not the only requirement that must be met. It is of decided advantage to locate field hospitals near dressing stations for the accommodation of the seriously injured who cannot stand transportation, if the military situation so permits.

Recent war experience has clearly demonstrated the injurious effects of transportation on patients who have penetrating abdominal wounds and other dangerous injuries accompanied by much shock, and the better results obtained by treating such cases at or near the locality where the injuries were incurred. Furthermore, it is hardly consistent with humane ideas to subject wounded with the mark of death on their brow to the painful process of transportation to a distance simply to assure them of safer shelter for the few remaining hours that they may have to live.

A greater distance from the front is permissible for the location of field hospitals than for dressing stations, but it must be considered that the further they are away from the dressing stations, the greater will be the labor required for the transfer of the wounded and the longer time it will require to get them under shelter. The possibility of a retreat should not prevent their being placed within a convenient distance and only the danger of being involved in the ordinary fluctuations of the line and being subjected to the enemy's fire make it advisable to act with caution.

Field hospitals should be as near to dressing stations as the military situation and safety permits. If conditions are such that they cannot be established until the conclusion of an engagement, there would be nothing to prevent them from being placed as close to the dressing station as a suitable location can be found.

The selection of a site for field hospitals presents fewer *difficulties than* in the case of the other stations for the reason

that they may be placed entirely beyond the danger zone from overshots and still be able to fulfill their proper function. Usually they will be so far in rear of the troops going into action that by the time they can be brought up the situation will have cleared up to some extent at least and a reasonably safe place can easily be found.

In deciding upon the location of field hospitals, the probable number of wounded that are to be cared for, the proximity of the evacuation hospitals, and the transport facilities will all have to be taken into account. If a stubborn fight is anticipated, a large number of wounded may be expected, and the field hospitals will have to be largely expanded, which would suggest locations near buildings that offered the necessary facilities. If evacuation hospitals are at a distance and can not be advanced within a reasonable time, and if the transport service cannot be set in motion at once, the question of shelter, convenience of getting supplies, and local sanitary conditions become more prominent. The resources afforded by a town or village would then be of special advantage.

Protection against enemy's fire must be assured either by placing the hospitals well beyond the range of fire or behind natural obstructions that give safe cover. A field hospital once definitely established is practically immobile and no such risks can be taken in locating them as in the case of the lighter organizations. The division surgeon must act with caution when he proposes to establish them anywhere near the scene of conflict, and he would hardly be justified in putting them well up to the front unless a successful outcome was apparent and the terrain was particularly favorable. He must not let his desire to save time in getting the wounded under shelter lead him astray and go so far to the front as to expose the hospitals to the danger of the enemy's fire. Efficient work cannot be done if the safety of the wounded and the hospital personnel is constantly threatened.

After a victorious engagement and when the enemy is driven from the field, the hospitals that have not already been established should be located at the most convenient points near the dressing

CHAPTER IX.

STATION FOR SLIGHTLY WOUNDED.

Stations for slightly wounded are established, usually one for each division, which serve as assembly points for such cases that do not require immediate hospital care and shelter and which are able to march some distance.

This station constitutes a new feature as far as our service is concerned. The necessity for some additional provision for the care of the wounded in the collecting zone is apparent when the small number and limited capacity of field hospitals is considered. These places are expected to not only facilitate the rapid collection and removal of a troublesome class of wounded from the front, but also to have some influence in limiting straggling in rear of the line by fixing a definite place where slight cases are to be assembled. "Skulking and straggling" will be discouraged by systematic provision for the slightly ill or injured where all who should be excused from duty may obtain proper authorization.

No permanent personnel or material is provided in regulations for this station, but it remains for the division surgeon to detail, in each case, medical officers and men from trains or from other organizations that will presumably not be actively engaged. A large force will not be needed as most of the wounded arriving there will have received at least a first-aid dressing at the aid or dressing stations. One medical officer and eight or ten men will probably prove ample for this service. The necessary food and surgical supplies are to be obtained from the reserve supply of the trains.

This station is primarily intended to relieve field hospitals and dressing stations of the slighter cases and to serve as an intermediate station for such on their way to hospitals on the line of

communications. It may also serve for the reception of the sick and exhausted who are unable to continue at the front and who after rest and refreshment may proceed to the rear. It is especially important that this class of patients should be kept away from the field hospitals as they would be the first to arrive, and in severe engagements, would fill them to overflowing before the severe cases could be brought.

No surgical service of any consequence is expected to be performed there and no elaborate arrangements need be made. Some dressings may have to be replaced or readjusted and possibly an operation to check hemorrhage or other extremely urgent surgical procedures may have to be carried out. A detached service chest and a box of reserve dressings would suffice for the purpose.

A systematic service must be assured by arranging a receiving and dressing section where wounded may be recorded and those who have not passed through the hands of medical officers at the front may be dressed and given diagnosis tags which may be considered as proper passports to the rear. A very important duty to be performed is the sorting of cases. Malingerers and slight cases that are deemed able to continue at the front in spite of minor illness or injury are to be sent back to their organizations. Patients with severe injuries who have inadvertently come there must be sent to the nearest field hospital.

A kitchen must be improvised so that food may be given to all. Rations and hospital stores may be obtained from the supply train. Some shelter for wounded is also necessary, especially in inclement weather, and it will usually be possible to find a building or a group of buildings for the purpose. Shelter is of greater importance after engagements that continue until late in the day or after nightfall when patients may have to be retained until next morning.

As soon as patients have received the necessary surgical attention and refreshments, they will be turned over to the forwarding section, and those who have been marked "duty" will be sent, after a rest, to their units. Others will be organized into *detachments* under a sanitary soldier or the senior among the

wounded, and directed to the advance base or other designated place where arrangements for their reception have been made by the chief surgeon of the line of communications. Each detachment thus sent must have specific directions as to the route to be followed and the destination, also instructions must be given as to the course to be pursued should any member of the detachment become unable to continue the march.

When detachments are sent to the rear it would be advisable to send some wheeled transportation along with them, whenever such can be obtained in the vicinity, to carry the men's packs and for those who may fall out and become unable to continue the march. Empty supply wagons or vehicles picked up in the neighborhood may be used for the purpose. Should it be impossible to procure wagons, such patients may have to be left in houses along the route and the line of communication authorities notified upon arrival at destination.

The selection of a location and the determination of the time for establishment can usually be made before the engagement begins and published in the division battle orders. It is of special importance that the whole command should be accurately informed of its whereabouts so that the slight cases occurring early in the engagement may soon find their way there and thus prevent the straggling referred to above. Medical officers and members of the hospital corps especially must be ready to give specific directions for finding the station and give information concerning the routes thereto.

As soon as troops form for battle the designated personnel and the supplies must be assembled there and the place prepared for the reception of wounded. If the assembly place for the sick of the command is chosen for the purpose, all that will be necessary will be to bring up the extra supplies that will be needed. Even in a rencounter there would probably be sufficient time to make all preparations before any wounded could be expected to arrive. Slightly wounded arriving at the dressing station or field hospital must at once be transferred and these institutions will then be relieved of an encumbrance and all attention can be given the more

serious cases, and when the time comes to break up, the slighter cases will all have been disposed of and the entire energies of the sanitary personnel can be devoted to those who require the most attention.

The question of distance from the field of losses is not of such importance as in the case of other stations, except perhaps in the case of an action that takes place late in the day or at night when the difficulty of finding a distant station would have to be taken into account.

As the slightly wounded will be expected to eventually march to the advance base or other place on the line of communications, it might seem to be a matter of indifference whether this station was one or ten miles away from the line of battle, but as a matter of fact it must be placed within convenient reach of the field of losses—just beyond the danger zone. The danger of being involved in wider fluctuations of the line is very small as it can be broken up at a moment's notice and moved out of the way.

The place selected must, if possible, be at some point that is well known to the troops, and generally on the route passed over by them, as slightly wounded men naturally drift back the way that they came. A site near some prominent land mark that can be seen at a distance, a town or village or crossroads through which troops have marched, is taken by preference.

The station should also be at some distance from field hospitals to prevent as much as possible, the slightly wounded from making demands upon the conveniences of these institutions. It will, perhaps, be found easier to prevent them from going there than to turn them out after arrival. It is also quite desirable that the place selected should be easily approachable from the front and on a convenient evacuation route to the rear. It is usually recommended that it should not be located on the main line of retreat for fear of obstructing the movements of advancing troops or ammunition columns, but it must be borne in mind that such route is perhaps the best known and most readily followed. For similar reasons it is often stated that the main route should *not* be designated for the subsequent evacuation of the station

and that some parallel road should be chosen, but the same objections apply as in the case of the site of the station.

It is quite safe to estimate that only about 15 per cent. of the wounded will be able to march some distance to the rear. Based upon this estimate, from 200 to 500 or more slightly wounded may be expected after severe engagements, sufficient to fill from one-half to the entire normal capacity of the field hospital of the division. The wisdom of making some additional provision for this class of cases would seem to be abundantly justified.

CHAPTER X.

LINE OF COMMUNICATIONS.

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LINE OF COMMUNICATIONS.

The very intimate relations which exist between the sanitary service of the lines of communication—the evacuating zone—and that of the front or collecting zone make it necessary that a brief sketch of the organization and function of the line of communication service should be given in connection with the discussion of the service in the collecting zone.

The lines of communication are embraced in the territory immediately in rear of the zone of operations. This territory is divided into a number of districts corresponding to the number of field armies composing the force at the front.

Each field army, as a rule, maintains its own line of communications within the district assigned to it, even if several are united to form an *army*.

The lines of communication may consist either of railway or water service or of both. In the absence of these, wagon transportation must be utilized. They include a base where depots of supplies and hospitals are maintained and supply or issue depots at the front.

As troops advance from the base, a line of communications is formed and its head must not be more than two days' march in rear. As the line extends, a chain of stations or intermediate bases is established, usually at intervals of about 15 miles, if the route is on a highway. These stations are protected by troops and may serve as convenient points for storing supplies and the establishment of hospitals and other sanitary institutions.

At the head of the line of communications a temporary base of supplies is established where division trains may obtain the

stores required by their units. This advance base may have to be moved from time to time to conform to the movements of the army.

A regular organization is provided for the service of the line of communications, headed by a commander who is provided with the necessary troops and a staff which includes a chief surgeon. The function of this organization is to keep the troops at the front provided with ample supplies of all kinds that may be required, and to transport the sick and wounded who are not expected to recover within a reasonable period to the base as rapidly as possible.

The chief surgeon, under the direction of the commander, must therefore co-operate not only with the service in the collecting zone, but also with that in rear of the base which is to relieve his institutions of non-effectives and upon which he must rely for supplies for the sanitary units at the front and in the evacuating zones. He must, therefore, act in accordance with instructions received from both mentioned sources and meet the demands of the organizations at the front for supplies, to take over their sick and wounded, and to evacuate them beyond the base at such times and to such places as may be directed by the War Department.

As indicated above, the relations of the sanitary service at the front and of the lines of communication are so intimate that it is quite impossible to fix a line of demarkation between them, but their organizations are, however, separate and distinct.

The organizations named on page 149 are mobilized for the line of communications service in such numbers as provided by regulations or the needs of the situation may demand.

The number of each of these institutions that may be required, transport columns, evacuation and base hospitals, and supply depots excepted, cannot be fixed as it depends entirely upon the length and character of the line of communications. The personnel for those which have no definite allowance will have to be specially provided by the War Department or perhaps by details from the regular organizations of the line of communications, re-enforced by Red Cross columns.

Organizations and Institutions	Medical officers	Sergeants 1st class	Sergeants	Privates	Dentists	Female nurses	Ambulances	Wagons	Bed capacity
Transport column....	2	2	8	32	...	...	12	1	...
Evacuation hospital...	14	8	16	129	...	...	3	2	324
Base hospital.....	20	8	16	129	1	46	3	2	500
Supply depot.....	2	1	2	12	...	...	...	...	...
Hospital train.....	3	1	2	24	...	...	...	...	200
Hospital ship.....	5	1	4	35	...	...	...	...	200
Convalescent camp...	Allowance of personnel not fixed, but is dependent upon circumstances.								
Casual camp for sanitary personnel.....									
Rest station.....									
Contagious disease hospital.....									
Receiving hospital at railway station or boat landing.....									
Red Cross column ...									

In preparation for a serious campaign a personnel and transportation reserve should be specially provided, not only for the service on the line of communications, but also to reinforce the sanitary units with the troops at the front in case of emergency.

In every great war it has become necessary, sooner or later, to largely increase the sanitary personnel, especially that of the

line of communications, and in the interest of economy and efficiency, regular provision for it should be made in our war organization. A systematic evacuation service cannot be carried on by unorganized and untrained civilians. The confusion and lack of co-ordination incidental to such a service has always proven most unsatisfactory and very expensive both as regards human life and treasure.

The allowance of evacuation and base hospitals is based upon the estimate that hospital provision will have to be made for about 6 per cent. of the force at the front and two of the former and one of the latter are mobilized for each division, affording a total normal capacity for 1148 patients for a division of 20,000 men.

The chief surgeon of a line of communications serving a field army would dispose over at least two transport columns, four evacuation and two base hospitals, two supply depots and such other institutions and organizations as the situation may require.

It has frequently been remarked that the success of the sanitary service at the front and on the line of communications depends very largely upon the rapidity with which non-effectives can be removed from the zone of operations. It must also be admitted that efficient service in the zones mentioned does not depend so much upon the quality of the professional work of individual medical officers as upon the systematic co-operation or "team work" in the matter of sanitation, removal, and incidental care and treatment of non-effectives by the sanitary organization.

The service on the line of communications is of infinitely greater importance, from a strictly professional standpoint, than that of the front, as sooner or later all the more severe cases of sickness or injury are turned over to it for temporary or permanent care and treatment. Its primary function is, however, the removal of non-effectives from the zone of operations, where, from a military point of view they constitute a serious impediment, but it must not be forgotten that at least temporary care and treatment of all patients is required during the process of evacuation and all sanitary units must be organized and equipped for this dual function.

In the efforts of the medical department to maintain the highest possible effective strength of the force at the front, *it is all-important that some relation should be maintained between the distance that patients are to be transported and the probable duration of their disabilities.* It is desirable that the slighter cases should be held and treated as near as practicable to the zone of operations so that no unnecessary time will be lost in returning them to their organizations upon recovery.

If the military situation, climatic and other conditions permit, no cases except such as will probably require prolonged hospital care and those permanently incapacitated should be sent further to the rear than the base of operations (base hospitals).

No definite time can be fixed upon for the stay of the various classes of cases on the line of communications as in preparation for battle or other emergencies the institutions may have to be cleared in anticipation of a large influx of sick and wounded, and much judgment and discrimination will have to be exercised in determining the extent of the evacuation process.

Transport columns are new organizations in our service and are to be mobilized at the rate of one for each division, for the purpose of connecting the front with the line of communication institutions and for service on the line itself. They must keep in touch with troops on the march and be prepared to take over the more serious cases for transportation to the nearest railway station, boat landing or hospital. This service is performed under the direction of the chief surgeon of the line of communications upon the demand of the chief surgeon of the field army, who notifies the former whenever sick of the command are assembled for evacuation.

Field hospitals will be cleared of patients by the transport columns whenever it is impracticable to convert them into evacuation hospitals. If there is no railway station or boat landing convenient to the battle-field, it may be necessary to largely augment these columns in preparation for battle by the addition of transportation provided for the line of communication for other purposes, by Red Cross columns or by hired vehicles, as these

units are only strong enough to meet the very ordinary emergencies. They should arrive on the ground not later than the morning after battle, and arrangements to that end must be made by the chief surgeon, who will have received timely notice of an impending engagement from the chief surgeon of the troops about to engage, who will also indicate the time and place where they will probably be most needed. The personnel of the transport column is also available to act as escort to the detachment of sick and wounded that are sent to the rear in boats or trains and to establish rest stations along the line of evacuation.

Evacuation hospitals are mobilized at the rate of two for a division. Each of these institutions has a bed capacity for 324 patients and may be divided into three sections. A section of an evacuation hospital includes sufficient personnel and equipment to relieve an established field hospital.

Evacuation hospitals have a more elaborate equipment than field hospitals, including everything required for three such units, transportation excepted; consequently when the latter are taken over by the line of communication organizations, all the materials and supplies in use with patients may be left with them and the field-hospital equipment completed from the supplies carried by the evacuation hospital.

Enough tentage is provided for the number of patients indicated, but if it becomes necessary that more permanent arrangements should be made, pavilions may be constructed according to the plans and specifications now on file in the office of the Surgeon-General. These plans provide for the most simple possible construction from material that can usually be found in any market. However, it would often be practicable to establish these institutions in towns and villages where buildings may be made use of.

Evacuation hospitals are intended for the temporary care and treatment of patients whose condition is such as to require them to be evacuated to the base or further to the rear, and when practicable for the definite treatment of those who may be expected to recover within a short period of time, and for such as cannot

stand transportation. They constitute the central point toward which the collecting zone converges and from which the evacuating and distributing zones diverge. They are, therefore, of the greatest importance as far as the removal of the sick and wounded is concerned. The evacuation hospitals constitute the link between all three zones and are the units which the chief surgeon must employ in establishing and maintaining the flow of sick and wounded between the field hospitals and the railway line of evacuation. In connection with battle service their function is similar to that of field hospitals which they supplement or relieve.

Field hospitals may be taken over on the ground by evacuation hospital organizations, or the patients may be transported to a conveniently located evacuation hospital, so that the field hospitals may be free to rejoin their units if there is a possibility of another engagement.

More permanent arrangements than are afforded by field hospitals will also have to be made at or near the battle-field for non-transportable wounded,and the chief surgeon must bear that in mind in making his plans for the use of the evacuation hospitals.

As troops advance from the base and the line of communications is extended, evacuation hospitals or sections thereof will have to be established at suitable points along the line, and especially at the advance base for the sick of the command. Preference would naturally be given to locations in towns that offered shelter and other conveniences for the care of patients.

It would be unwise to send those that only require a short period of treatment further back than the evacuation hospitals, if military and climatic conditions permit, as much time would unnecessary be lost in returning men to their organizations upon recovery, thus materially reducing the effective strength at the front.

An evacuation hospital or a section thereof may have to be established as a hospital for contagious disease as it is hardly consistent with our ideas of sanitation to attempt to move such cases a long distance from the zone of operations if proper provision can be made on the line of communications.

Whenever an engagement is imminent, the established hospitals would have to be cleared as far as possible in anticipation of the arrival of large numbers of wounded, and those institutions which are available must be advanced within reach of the battle-field to relieve and supplement field hospitals on the ground in case of a successful termination of the engagement. If there is a rail- or waterway convenient to the field of operations these institutions are to be loaded on cars or boats in readiness to be forwarded upon telegraphic notice. One of these institutions would probably be at once established at the rail head or boat landing to act as receiving hospital for those who are in process of evacuation.

Ordinarily it would be advisable to begin the evacuation to the rear at once, even in case of victory, as it is quite desirable to clear the zone of operations of wounded as soon as possible; as their presence would not only be an impediment to the movements of the troops, but they would also complicate the supply problem of the army. When evacuation hospitals take over field hospitals on the ground, a provisional establishment only would be contemplated and arrangements made for their speedy evacuation.

Should the field of battle be a day's march or more from the rail- or waterway, evacuation hospitals should be advanced to the nearest station in anticipation of the engagement, in readiness to be moved up to within reach of the field, so that in case of victory some of them may be established near it to relieve field hospitals in order that they may rejoin their units in case of an advance and a renewal of the engagement.

It would be the duty of the chief surgeon of the line of communications to provide the necessary transportation for evacuation hospitals that are to be moved over ordinary roads, by drawing upon the trains belonging to the line of communications and Red Cross columns or by requisition upon the civilian population of the district.

It is believed that the necessity of providing regular transportation for at least one of the evacuation hospitals of each division will at once appear in a great campaign, and provision

therefore should be made in our war organization. This necessity would perhaps be best met by an allowance of motor vehicles About thirty four-mule wagons would be required to transport the light equipment of one of these hospitals. A considerable reduction in the weight of the material will be accomplished by leaving out the tentage which would not be needed if the hospital is to be established in a town.

A base hospital with a bed capacity for 500 patients is mobilized for each division, which is to serve as a safer and more permanent institution for the treatment of patients than evacuation hospitals. Its equipment is much more complete than other hospitals near the front and approaches that of general hospitals.

Base hospitals also constitute the link between the evacuating and distributing zones and serve to relieve the more temporary institutions of patients, especially of those who will require prolonged treatment or who are permanently incapacitated. On account of their better equipment, safer location, and proximity to the source of supplies, they are better able to take care of the more serious cases. The definite classification of cases is also carried on in base hospitals, and all such as will require prolonged treatment and those incapacitated for further service are, under instructions from the War Department, promptly evacuated and distributed among general hospitals.

The outflow of patients from the line of communications to general hospitals must keep pace with the influx from the institutions in the collecting and evacuating zones, otherwise the service of the base and evacuating hospitals and finally that of the field sanitary units will become clogged. The chief surgeon of the line of communications must therefore not only arrange to meet the demands of the troops at the front, but also by timely and far-sighted representations to the War Department or to the chief surgeon of the army in the field, obtain the necessary means and facilities to initiate the further evacuation of non-effectives to general hospitals.

In anticipation of a large influx of wounded from the battle-field, special efforts may have to be made to clear base hospitals as well

as evacuation hospitals of sick, and a prompt and efficient evacuation service must be provided from the very beginning.

As indicated by their name, base hospitals are usually established near the base of operations which corresponds to the rear end of the line of communications and marks the beginning of the general line, the sanitary service of which is directly under the control of the Surgeon-General and the War Department.

Base hospitals are to be established in towns where suitable buildings may be made use of, but in case of necessity pavilion hospitals may be built in accordance with plans and specifications that have already been prepared in the office of the Surgeon-General.

The medical supply service is of such great importance to the sanitary department at the front that it merits exhaustive consideration in a work that professes to treat of the service of the medical department in the field; but in view of the fact that it is so completely covered in the Manual for the Medical Department, little need be said on the subject here.

A supply depot is mobilized for every division which follows its unit into the field. It remains, however, at the base of operations or at some other convenient point on the line of communications where the necessary transportation facilities may be had. When divisions are united to form field armies, the depots may be combined or they may be established at different points as may be called for by the special situation. As the line of communications is extended by the advance of the troops, a depot or a section thereof must be brought up and finally established at the advance base for the convenience of sanitary organizations serving with troops at the front.

The depots must be prepared to replace the materials used at the front and in the institutions on the line of communications, and to furnish the supplies necessary to improvise additional hospitals, hospital trains or boats, rest stations, convalescent camps, etc., etc.

The personnel, organization, and capacity of hospital trains and boats is laid down in regulations, but thus far no definite

steps have been taken to provide hospital cars and boats for use in time of war, and they will have to be improvised when the emergency arises.

Certain supplies and materials, including litter supports, necessary to fit up passenger and freight cars are contained in the field supply depots so that boats and trains can be hastily prepared to transport patients. Trains that bring supplies to the front may thus be prepared to bring back patients and systematic arrangements for such a service must be made by the chief surgeon.

It must also be noted that hospital provision will have to be made at every post or station established along the line of communication, not only for the reception of the sick of the garrison of the place, but also for such as may be left behind by troops passing through on their way to the front. Such improvised hospitals may become of great importance if near enough to the battle-field to be reached by wounded *en route* to the regular evacuation line.

Nothing definite can be laid down concerning the organization, equipment, and service of those institutions mentioned in regulations for which no definite personnel is provided. Their organization and equipment constitute an important problem for the chief surgeon, which will have to be worked out at the time and place. They are important because of the relation to the evacuation service. The personnel and supplies of Red Cross organizations will probably have to be largely relied upon for service at such stations.

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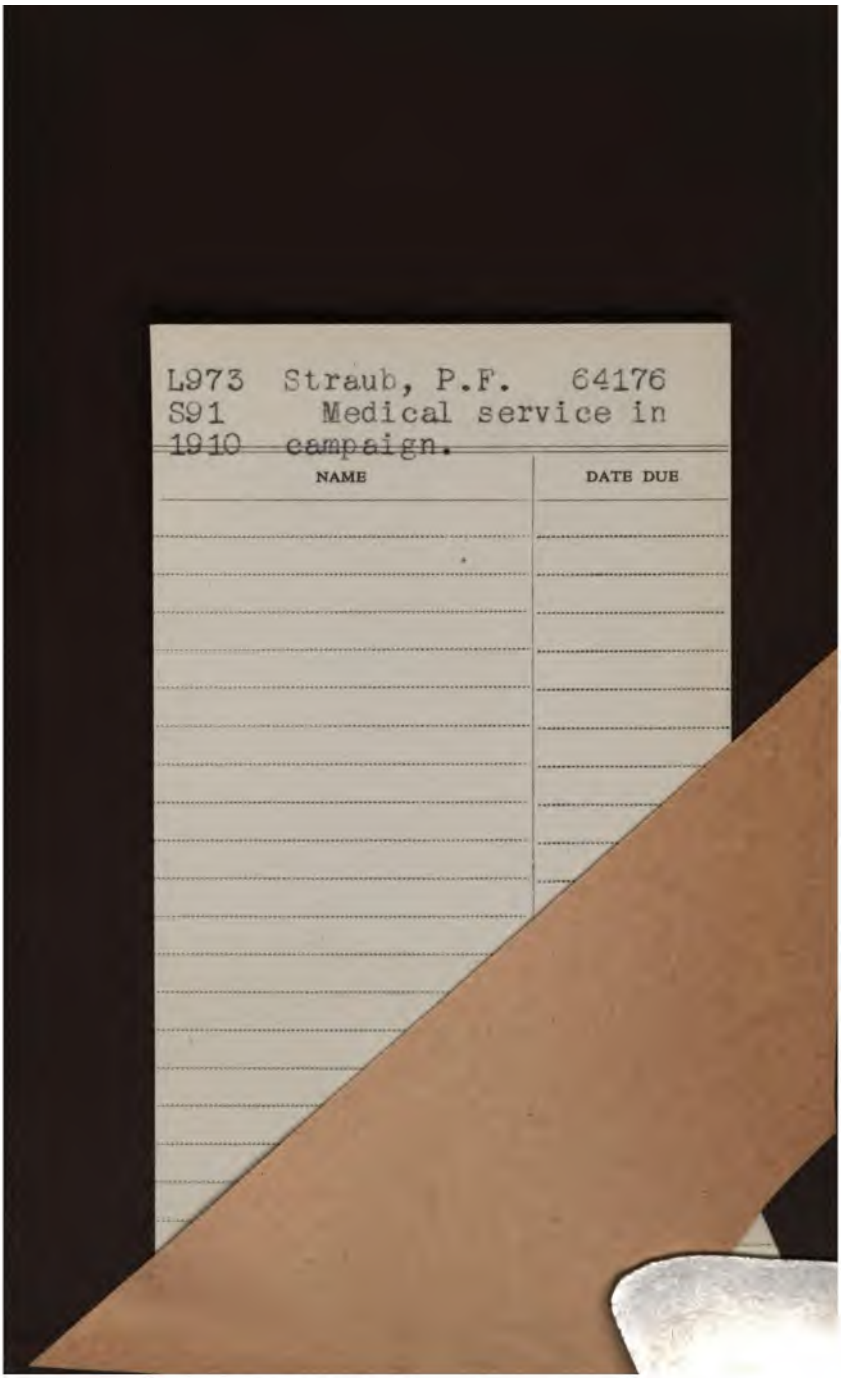
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